Salmon Farming Industry Handbook

2019

Forward-looking Statements

This handbook includes forward-looking statements that reflect Mowi's current expectations and views of future events. These forward-looking statements use terms and phrases such as "anticipate", "should", "likely", "foresee", "believe", "estimate", "expect", "intend", "could", "may", "project", "predict", "will" and similar expressions.

These forward-looking statements include statements related to population growth, protein consumption, consumption of fish (including both farmed and wild), global supply and demand for fish (and salmon in particular), aquaculture's relationship to food consumption, salmon harvests, demographic and pricing trends, market trends, price volatility, industry trends and strategic initiatives, the issuance and awarding of new farming licences, governmental progress on regulatory change in the aquaculture industry, estimated biomass utilization, salmonid health conditions as well as vaccines, medical treatments and other mitigating efforts, smolt release, development of standing biomass, trends in the seafood industry, expected research and development expenditures, business prospects and positioning with respect to market, and the effects of any extraordinary events and various other matters (including developments with respect to laws, regulations and governmental policies regulating the industry and changes in accounting policies, standards and interpretations).

The preceding list is not intended to be an exhaustive list of all our forward-looking statements. These statements are predictions based on Mowi's current estimates or expectations about future events or future results. Actual results, level of activity, performance or achievements could differ materially from those expressed or implied by the forward-looking statements as the realization of those results, the level of activity, performance or achievements are subject to many risks and uncertainties, including, but not limited to changes to the price of salmon; risks related to fish feed; economic and market risks; environmental risks; risks related to escapes; biological risks, including fish diseases and sea lice; product risks; regulatory risks including risk related to food safety, the aquaculture industry, processing, competition and anti-corruption; trade restriction risks; strategic and competitive risks; and reputation risks.

All forward-looking statements included in this handbook are based on information available at the time of its release, and Mowi assumes no obligation to update any forward-looking statement.

Mowi Salmon Farming Industry Handbook

The purpose of this document is to give investors and financial analysts a better insight into the salmon farming industry, and what Mowi considers to be the most important value drivers.

Table of content

MOWI

1 Introduction

Introduction

Salmon is the common name for several species of fish of the family Salmonidae (e.g. Atlantic salmon, Pacific salmon), while other species in the family are called trout (e.g. brown trout, seawater trout). Although several of these species are available from both wild and farmed sources, most commercially available Atlantic salmon is farmed. Salmon live in the Atlantic Ocean and the Pacific, as well as the Great Lakes (North America) and other landlocked lakes.

Typically, salmon are anadromous: they are born in fresh water, migrate to the ocean, then return to fresh water to reproduce.

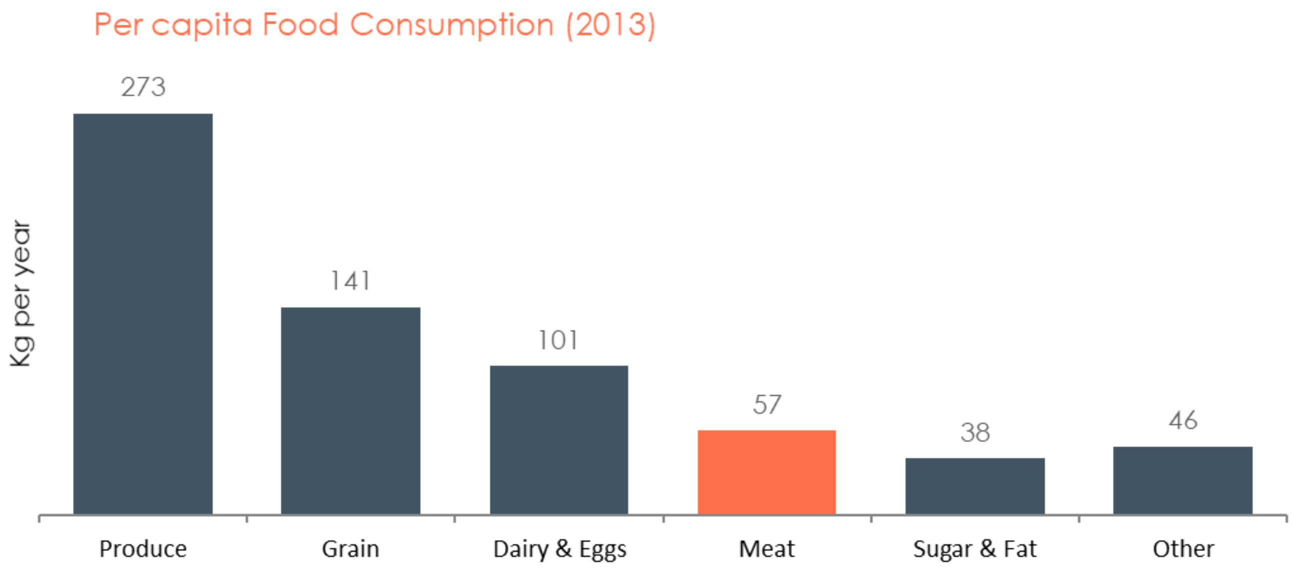
About 72% of the world's salmon harvest is farmed. Farming takes place in large nets in sheltered waters such as fjords or bays. Most farmed salmon come from Norway, Chile, Scotland and Canada.

Salmon is a popular food. Salmon consumption is considered to be healthy due to its high content of protein and Omega-3 fatty acids and it is also a good source of minerals and vitamins.

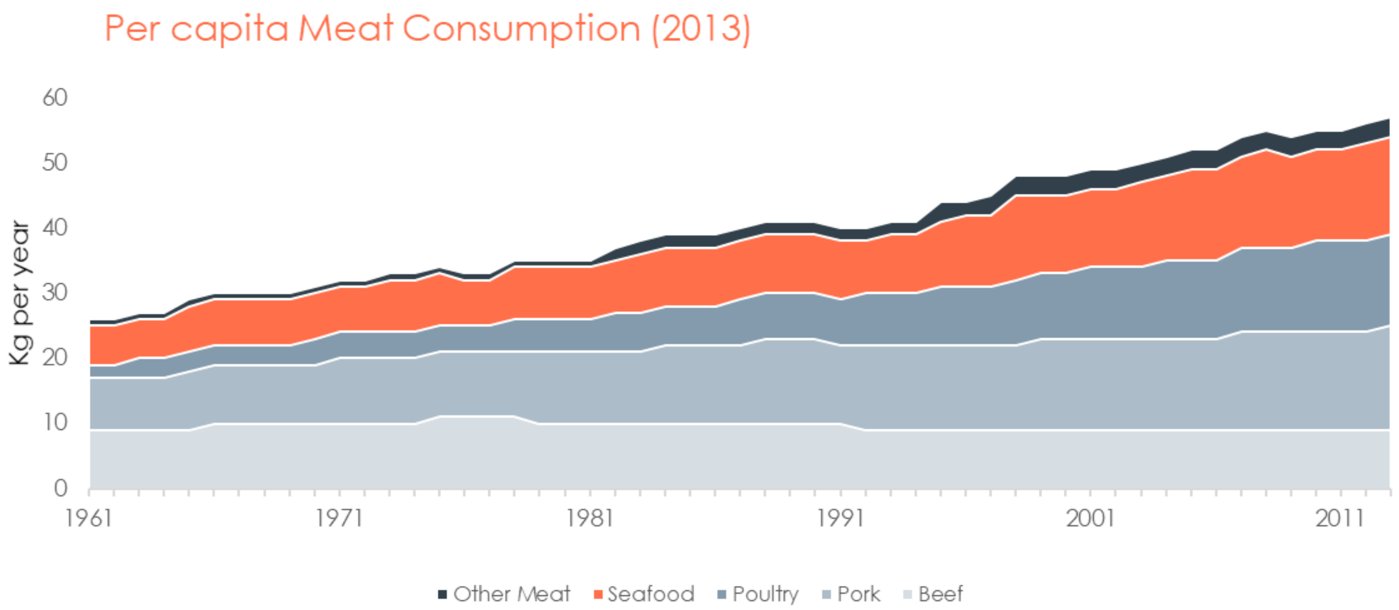
2 Positioning of Salmon

Positioning of Salmon

2.1 Seafood as part of food consumption



The average human eats around 656 kg of food each year. Most of this food is produce such as vegetables, fruits, and starchy roots. Animal protein, such as seafood, poultry, pork, and beef, amounts to just under 10% of the total diet.



Meat as a food source has gradually become more important. The global per capita consumption has more than doubled since 1961, and the seafood segment is a big contributor to this increase.

Source: FAO (2013); FAOstat Food Balance Sheets

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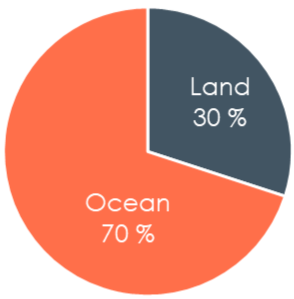
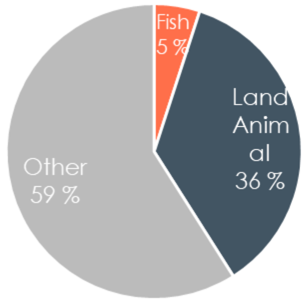
2.2 Seafood as part of overall protein consumption

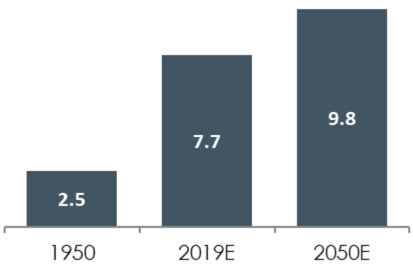
World Surface



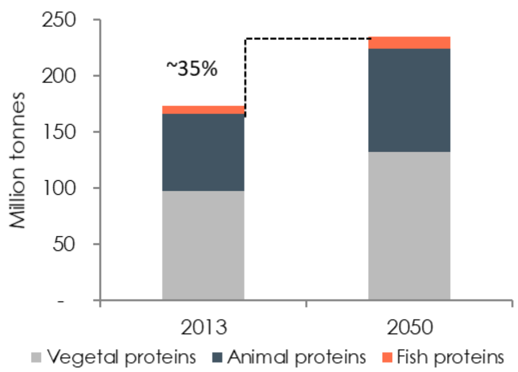
Protein Sources for human Consumption



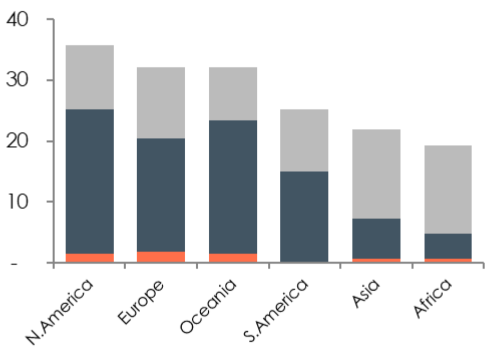
World Population (billion)



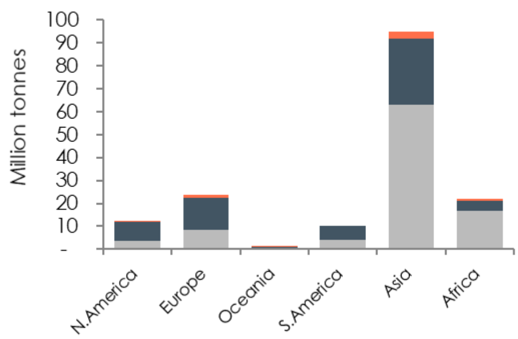
Implied protein consumption driven by population growth only



Protein consumption in kg per capita (2013)



Total protein consumption by continent (2013)



The UN estimates that the global population will grow to approximately 9.77 billion by 2050.

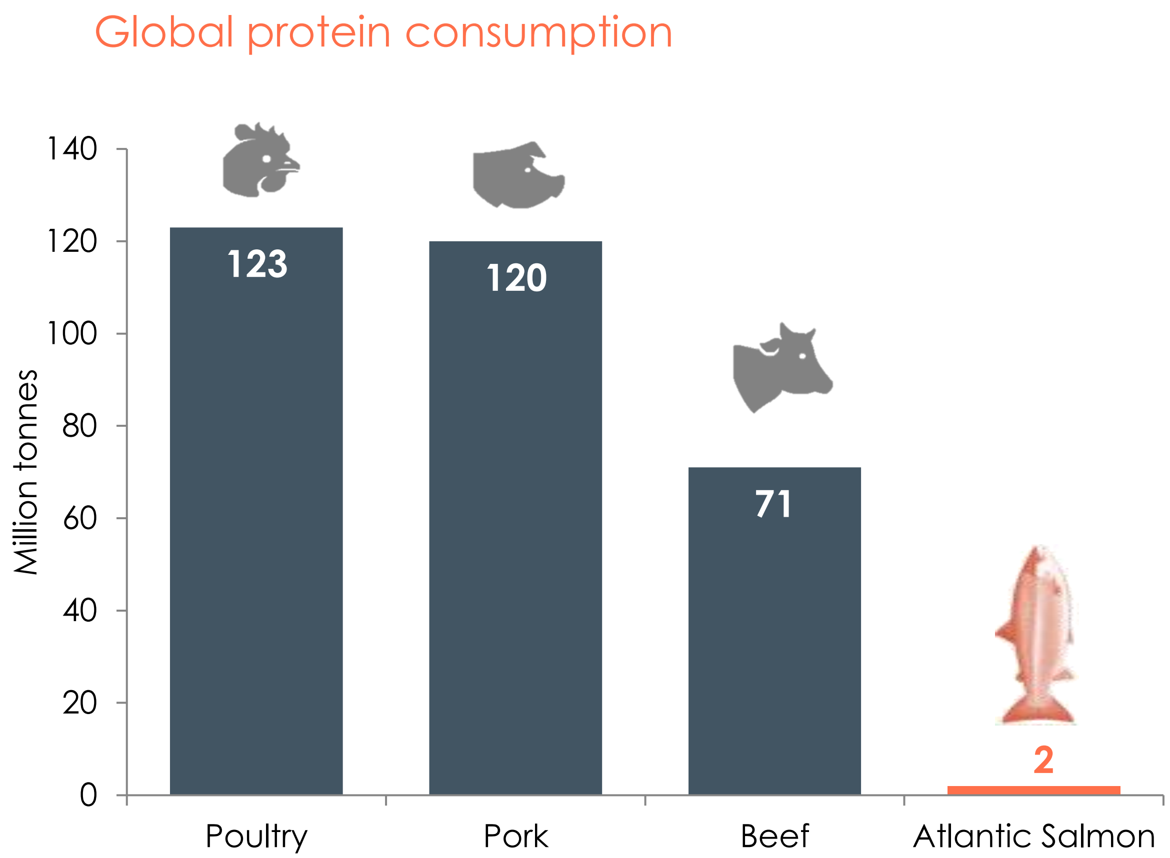
Although 70% of the Earth's surface is covered by the ocean, only 5% of the protein sources for human consumption are produced there.

Assuming consumption per capita stays constant, this implies a 35% increase in demand for protein. The UN however, estimates that the actual demand will double. We know that resources for increased land-based protein production will be scarce, so a key question is how the production of protein sources from the sea can be expanded.

Source: FAO (2013); FAOstat Food Balance Sheets, United Nations population data; *World Population Prospects: The 2018 Revision*

Positioning of Salmon

2.3 Atlantic Salmon as part of the global protein consumption



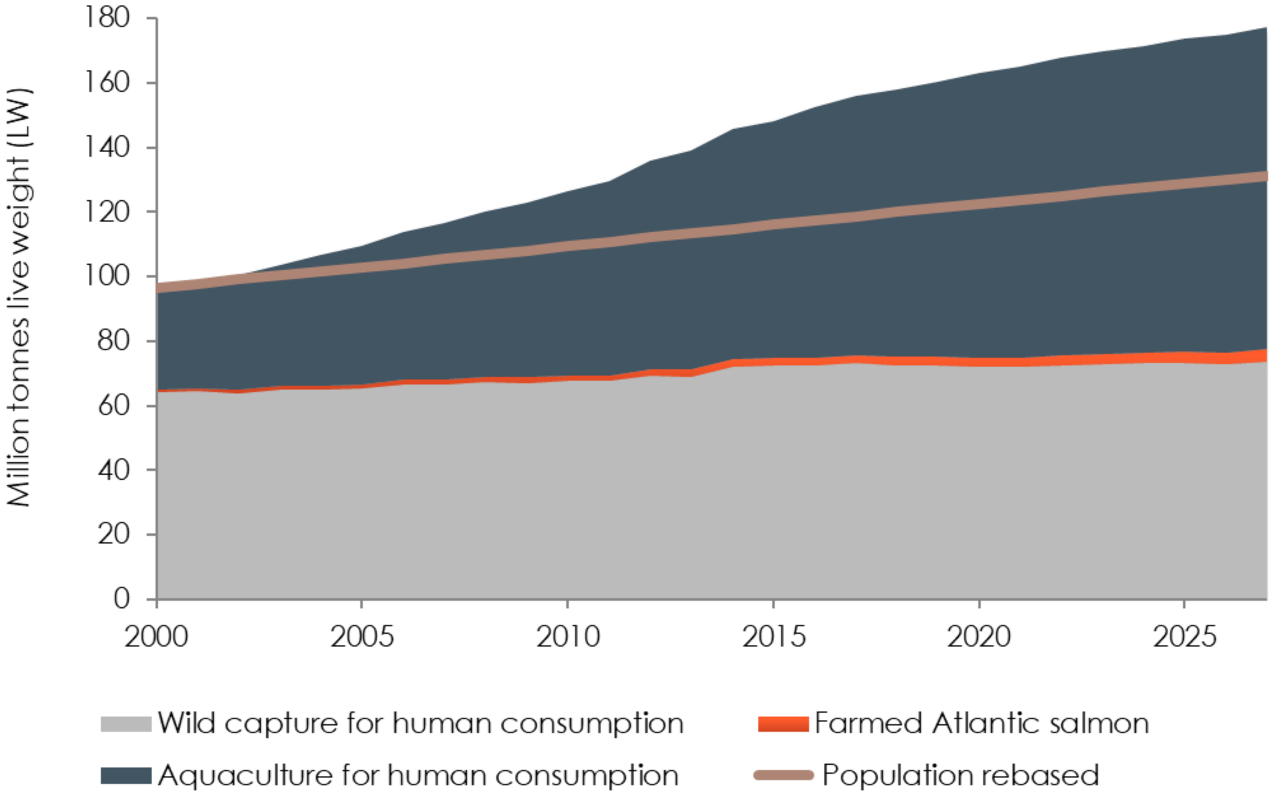
Most animal protein in our diets comes from pork, poultry, and beef, with salmon consumption representing a small portion of global protein consumption.

In 2018, FAO estimated consumption of 123 million tonnes Ready to Cook Equivalent (rtc) of poultry, 120 million tonnes Carcass Weight Equivalent (cwe) of pork, and 71 million tonnes (cwe) of beef and veal.

In contrast, the total consumption of farmed Atlantic salmon was around 2.2 million tonnes (GWT). This corresponds to about 1.5 million tonnes in product weight. If we combine all salmonids both the farmed and wild it amounts to 3.2 million tonnes (GWT) in 2018.

Source: OECD-FAO (2018) *Agricultural Outlook 2018-2027, Kontali Analyse*

2.4 Stagnating wild catch – growing aquaculture



Over the past few decades, there has been a considerable increase in total and per capita fish supply. As the fastest growing animal-based food producing sector, aquaculture is a major contributor to this, and its growth outpaces population growth.

Great progress in breeding technology, system design and feed technology in the second half of the twentieth century has enabled the expansion of commercially viable aquaculture across species and in volume. In 2013-15, China alone produced 62% of global aquaculture output, while Asia accounted for 88%.

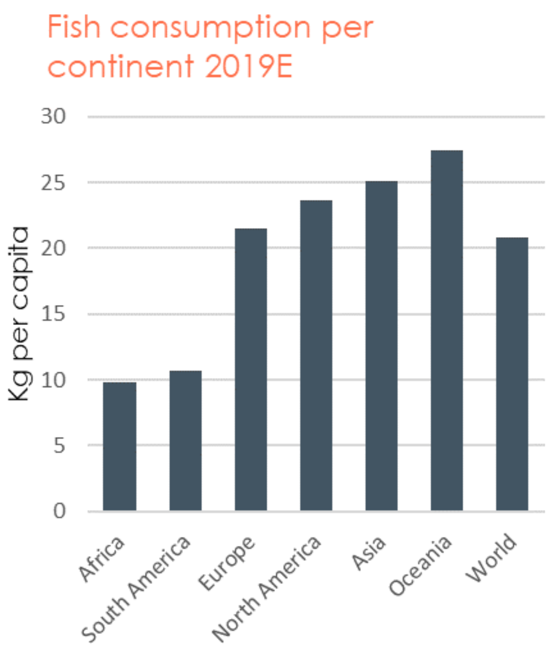
The World Bank developed a scenario analysis in their report *Fish to 2030* (2013) predicting that aquaculture will continue to fill the supply-demand gap, and that by 2030, 62% of fish for human consumption will come from this industry.

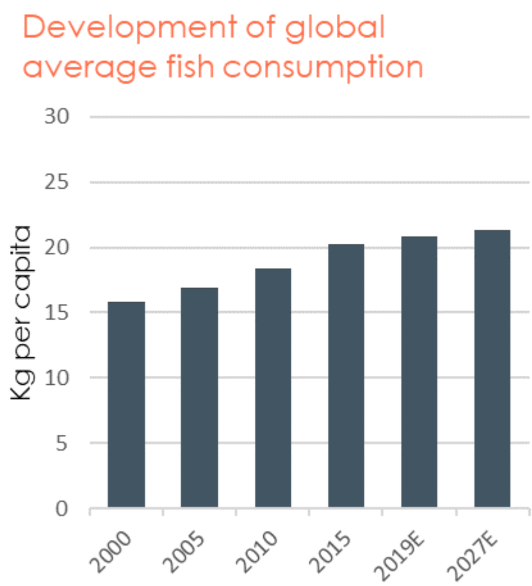
In 2018, aquaculture accounted for 83 million tonnes (LW) destined for direct human food consumption, while wild capture accounted for 73 million tonnes (LW). However, fish has been estimated to account for only 5% of global protein consumption (and about 12% of total fish and animal protein supply).

Sources: FAO (2013) *World Fisheries and Aquaculture*, OECD-FAO (2018) *Agricultural Outlook 2018-2027*, World Bank (2013) *Fish to 2030*, *Kontali Analyse*

Positioning of Salmon

2.5 Fish consumption





Given the expected *production* growth of 10% during 2018–2027 and the projected world *population* growth of 9% over the same period, we will most likely see a global increase in the average fish consumption level.

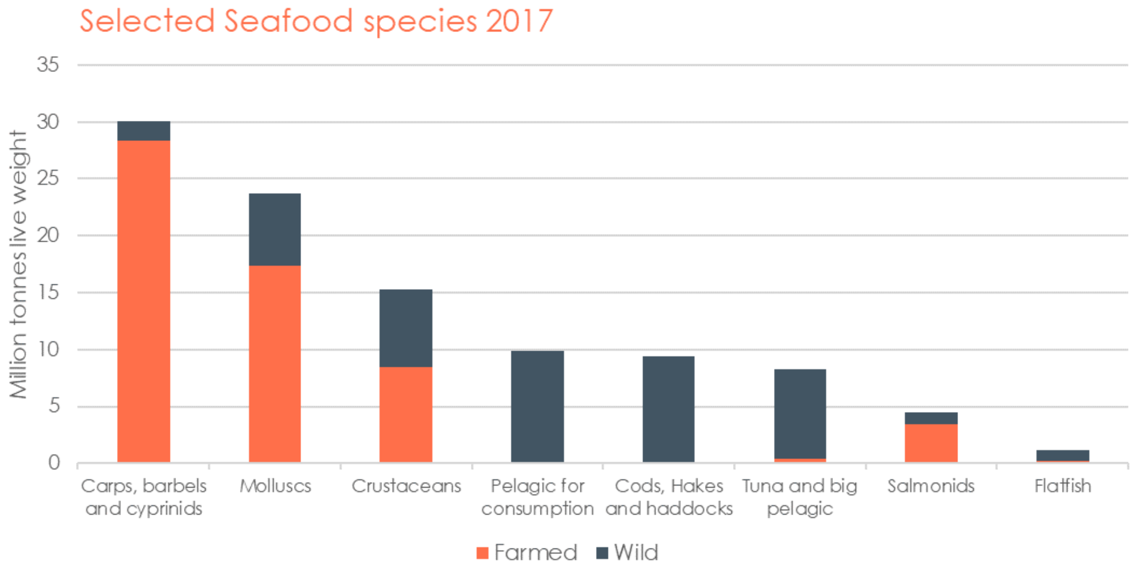
By 2027, per capita fish consumption is estimated to be 21.3 kg (vs. 9.9kg in the 1960s and 20.8kg in 2018). This is equivalent to another 23 million tonnes of seafood supply, which aquaculture is estimated to provide.

According to FAO, per capita consumption is expected to increase by 3% in the period 2018-2027. Latin America is expected to have the highest growth, whilst negative growth is anticipated in Africa and North America. In general, per capita fish consumption is likely to grow faster in developing countries. However, more developed economies are expected to have the highest per capita consumption.

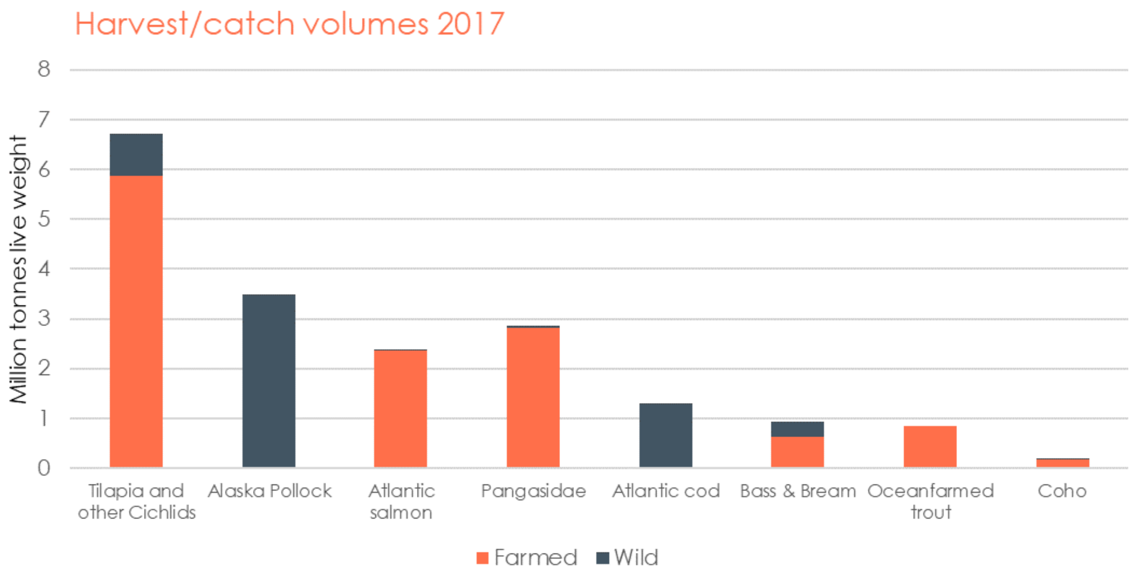
Sources: FAO (2018); The State of World Fisheries and Aquaculture OECD-FAO (2018) Agricultural Outlook 2018-2027

Positioning of Salmon

2.6 Salmonids contribute 4.4% of global seafood supply



Although several salmon species are available from both wild and farmed sources, almost all commercially available Atlantic salmon is farmed. Even with an increase in production of Atlantic salmon of more than 800% since 1990, the total global supply of salmonids is still marginal compared to most other seafood categories (4.4% of global seafood supply). Whitefish is about ten times larger and comprises a much larger number of species.

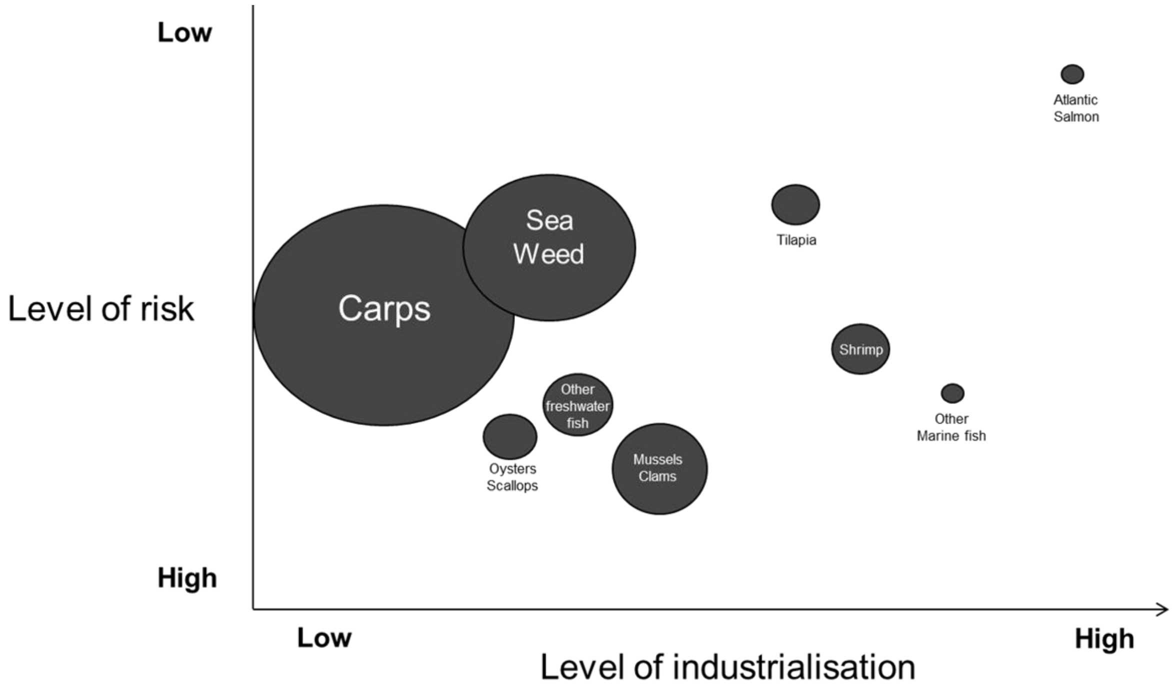


In 2017, more Atlantic salmon was harvested than Atlantic cod. However, the harvest of Atlantic salmon was only about 23% of that of two of the largest whitefish species, tilapia and Alaska pollock.

Note: Live weight (LW) is used because different species have different conversion ratios
Source: Kontali Analyse

Positioning of Salmon

2.7 Considerable opportunities within aquaculture



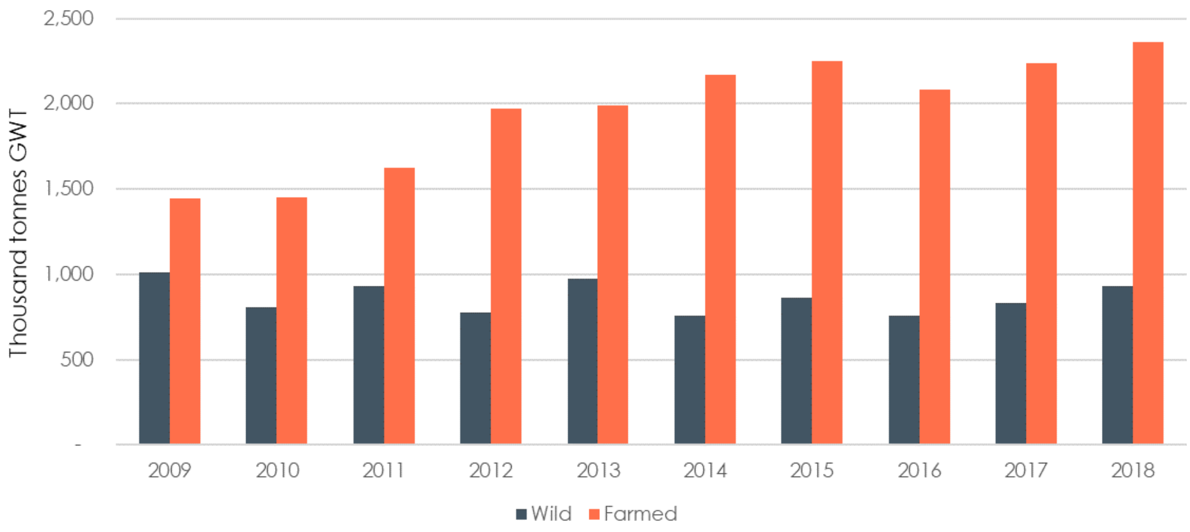
The illustration above shows that Atlantic salmon has the highest level of industrialisation and the lowest level of risk compared to other aquaculture species. The size of the circles indicates volume harvested.

Although Atlantic salmon is relatively small in harvest volume compared to other species, it is a very visible product in many markets due to the high level of industrialisation.

Source: Kontali Analyse

Positioning of Salmon

2.8 Supply of farmed and wild salmonids



The general supply of seafood in the world is shifting more towards aquaculture as the supply from wild catch is stagnating in several regions and for many important species. Wild catch of salmonids varies between 700,000 and 1,000,000 tonnes GWT, whereas farmed salmonids are increasing. The total supply of salmonids was first dominated by farmed in 1999. Since then, the share of farmed salmonids has increased and has become the dominant source.

The total supply of all farmed salmonids exceeded 2.36 million tonnes (GWT) in 2018. The same year, the total catch volume of wild salmonids was a bit more than one third of farmed, with chum, pink and sockeye being the most common species.

About 20% of the total wild catch of salmon is imported frozen by China (from the US, Russia and Japan), and later re-exported as frozen fillets.

Source: Kontali Analyse

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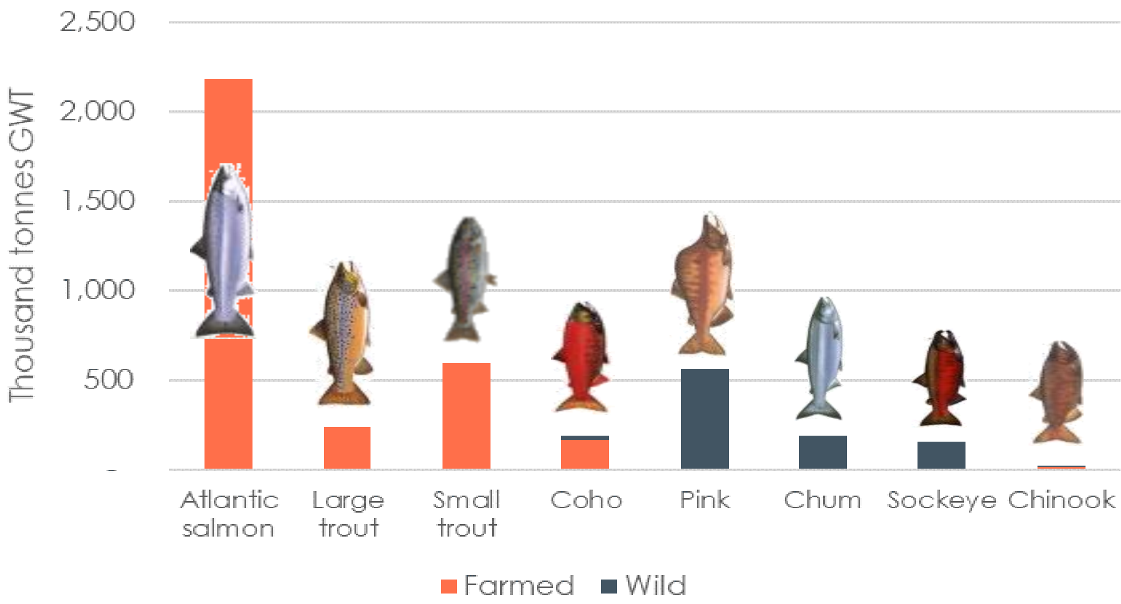
Positioning of Salmon

2.9 Salmonids harvest 2018



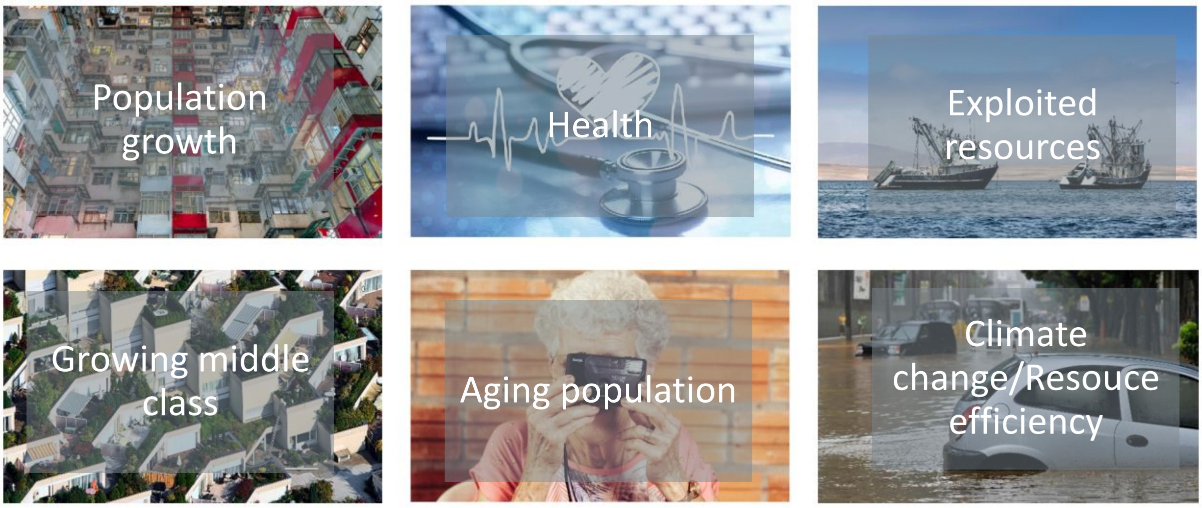
Atlantic salmon: By quantity, the largest species of salmonids. Farmed Atlantic salmon is a versatile product, which can be used for a variety of categories such as smoked, fresh, sushi, as well as ready-made meals. The product is present in most geographies and segments. Due to biological constraints, seawater temperature requirements and other natural constraints, farmed salmon is only produced in Norway, Chile, UK, North America, Faroe Islands, Ireland, New Zealand and Tasmania.
Large trout: Produced in Norway, Chile and the Faroe Islands, the main markets are Japan and Russia. Trout is mainly sold fresh, but is also used for smoked production.
Small trout: Produced in many countries and most often consumed locally as a traditional dish as hot smoked or portion fish. Small trout is not in direct competition with Atlantic salmon.
Coho: Produced in Chile and is mostly used for salted products. It is a competitor of trout and sockeye in the red fish market. Although Russia has increased its import of this fish over the last few years, Japan remains the largest market.
Pink: Caught in USA and Russia and used for canning, pet food and roe production. Since quality is lower than the other species it is a less valued salmonid. The fish is small in size (1.5-1.7 kg) and is caught over a very short time period.
Chum: Caught in Japan and Alaska. Most is consumed in Japan and China. In Japan, it is available as fresh, while in China it is processed for local consumption and re-exported. Little chum is found in the EU market. The catch varies in quality and part of the catch is not fit for human consumption.
Sockeye: Caught in Russia and Alaska. It is mostly exported frozen to Japan, but some is consumed locally in Russia and some canned in Alaska. Sockeye is seen as a high quality salmonid and is used for salted products, sashimi and some is smoked in the EU.
Chinook/King: Small volumes, but highly valued. Alaska, Canada and New Zealand are the main supplying countries. Most quantities are consumed locally. Chinook is more in direct competition to Atlantic salmon than the other species and is available most of the year.

Source: Kontali Analyse

3 Salmon Demand

Salmon Demand

3.1 Global macro trends



The industry is a good fit with the global macro trends, as Atlantic salmon is a healthy, resource-efficient and climate-friendly product produced in the sea.

The global population is growing, resulting in increased global demand for food. As the middle class is growing in large emerging markets, we expect consumption of high-quality proteins to increase.

The health benefits of seafood are increasingly being promoted by global health authorities. The EAT-Lancet Commission recommends increased consumption of fish, dry beans and nuts as sustainable, healthy protein sources.

Global fisheries are to a large extent fully exploited, meaning the supply of wild fish has limited potential to meet the growing demand for marine protein.

The middle class is growing in large emerging markets, allowing more people to eat different, and more nutritious, protein rich foods, such as fish, meat and eggs.

Another demographic trend that are driving shifts in demand, is the aging population. Eating healthy becomes especially important as you age.

Climate change is the greatest environmental challenge the world has ever faced. The world must reduce its CO2 emissions footprint to avoid global warming. For food production soil erosion is an increasing issue, challenging the world to investigate new ways of feeding the population.

Salmon Demand

3.2 A healthy product

Atlantic salmon is rich in long chain omega-3, EPA and DHA, which reduce the risk of cardiovascular disease. Data also indicates that EPA and DHA reduce the risk of a large number of other health issues.

Salmon is nutritious, rich in micronutrients, minerals, marine omega-3 fatty acids, high-quality protein and several vitamins, and represents an important part of a varied and healthy diet. FAO highlights that: "Fish is a food of excellent nutritional value, providing high quality protein and a wide variety of vitamins and minerals, including vitamins A and D, phosphorus, magnesium, selenium and iodine in marine fish".

The substantial library of evidence from multiple studies on the nutrients present in seafood indicates that including salmon in your diet will improve your overall nutrition and may even yield significant health benefits. Considering global obesity rates, governments and food and health advisory bodies around the world are encouraging people of all ages to increase their seafood intake, with particular focus on the consumption of oily fish, such as salmon. The U.S. Department of Health and the US Department of Agriculture recommend an intake of at least 237 grams of seafood per week for Americans in general. The UK National Health Service, the Norwegian Directorate of Health and several other national health organisations recommend eating fish at least twice a week.

Source: FAO, Mowi, WHO, The Norwegian Directorate of Health (2011), Health and Human Services (2010), US Department of Health (2016) *Dietary guidelines for Americans 2015-2020*

Salmon Demand

3.3 Resource-efficient production

Protein retention	31 %	34 %	18 %	15 %
Energy retention	23 %	25 %	14 %	27 %
Edible Yield	68 %	46 %	52 %	41 %
Feed conversion Ratio (FCR)	1.1	1.9	3.0	4-10
Edible Meat per 100 kg fed	61 kg	24 kg	17 kg	4-10 kg

To optimize resource utilization, it is vital to produce animal proteins in the most efficient way. Protein resource efficiency is expressed as "Protein retention", which is a measure of how much animal food protein is produced per unit feed protein fed to the animal. Salmon has a protein retention of 31%, which is the most efficient in comparison with chicken, pork, and cattle (see table above).

Energy retention is measured by dividing energy in edible parts by gross energy fed. Both cattle and Atlantic salmon has a high energy retention compared to pork and chicken.

The main reason why salmon convert protein and energy to body muscle and weight so efficiently is because they are cold-blooded and therefore do not have to use energy to heat their bodies. They also do not use energy standing up like land animals.

- Edible yield is calculated by dividing edible meat by total body weight. As much as 68% of Atlantic salmon is edible meat, while other protein sources have a higher level of waste or non-edible meat.

- Feed conversion ratios measure how productive the different animal protein productions are. In short, this tells us the kilograms of feed needed to increase the animal's bodyweight by one kg. Feed for Atlantic salmon is high in protein and energy which accounts for the feed conversion ratio being even more favourable for Atlantic salmon than protein and energy retention when compared with land animal protein productions.

- Edible meat per 100kg of feed fed: The combination of the FCR ratio and edible yield, gives salmon a favourably high quantity of edible meat per kg of feed fed.

Source: Fry et al (2017) Feed conversion efficiency in aquaculture: do we measure it correctly? *Ytrestøyl T., Aas T.S., Åsgård T. (2014) Resource utilisation of Norwegian salmon farming in 2012 and 2013.* Cassidy E S et al (2013) Redefining agricultural yields: from tonnes to people nourished per hectare. Shepon A et al (2016) Energy and protein feed-to-food conversion efficiencies in the US and potential food security gains from dietary changes.

Salmon Demand

3.4 Climate friendly production

In addition to its resource-efficient production, farmed fish is also a climate-friendly protein source. It is expected to become an important solution to providing the world with vitally important proteins while limiting the negative effect on the environment. There is for example less environmental impact in salmon production compared to other protein producers.

When comparing the environmental impact of farmed salmon to traditional meat production, the carbon footprint for the farmed salmon is 2.9 carbon equivalents per kilogram of edible product whilst corresponding figures are 2.7kg and 5.9kg of edible product for chicken and pork, respectively. Cattle's carbon footprint is as much as 30 carbon equivalents per kilogram of edible product.

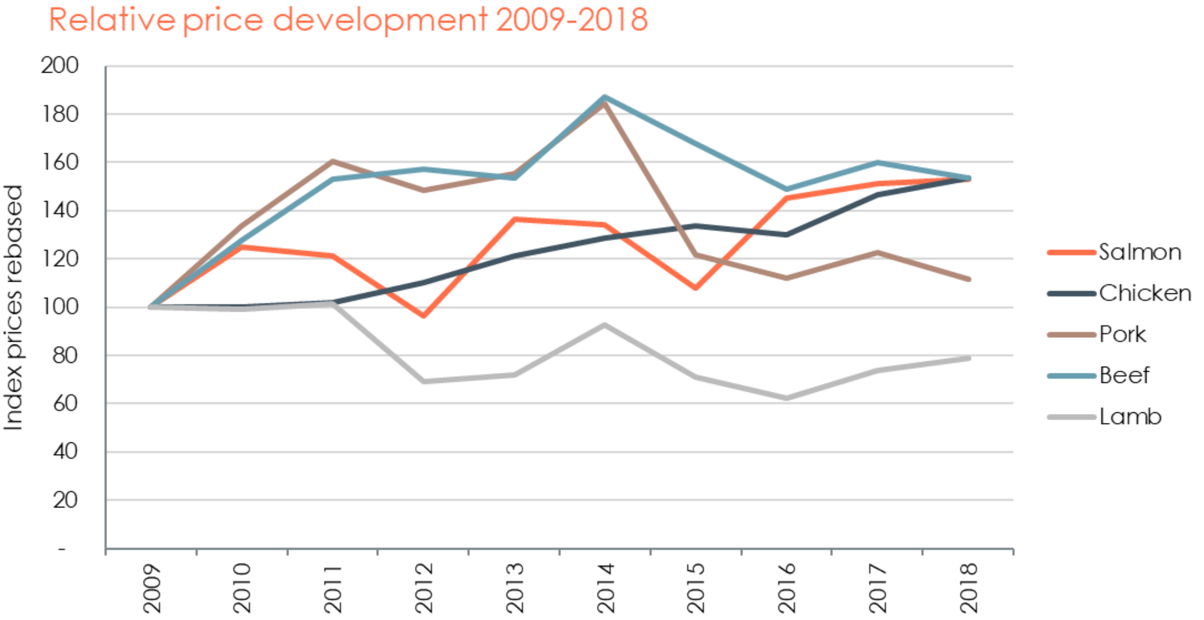
Freshwater is a renewable but limited natural resource, and human activities can cause serious damage to the surrounding environment. In Norway, farmed Atlantic salmon requires 2,000 litres per kg of fresh water in production which is significantly less than other proteins.

Carbon Footprint				
Kg CO2 / Kg edible meat	2.9 kg	2.7 kg	5.9 kg	30 kg
Water consumption				
Litre / Kg edible meat	2,000*	4,300	6,000	15,400

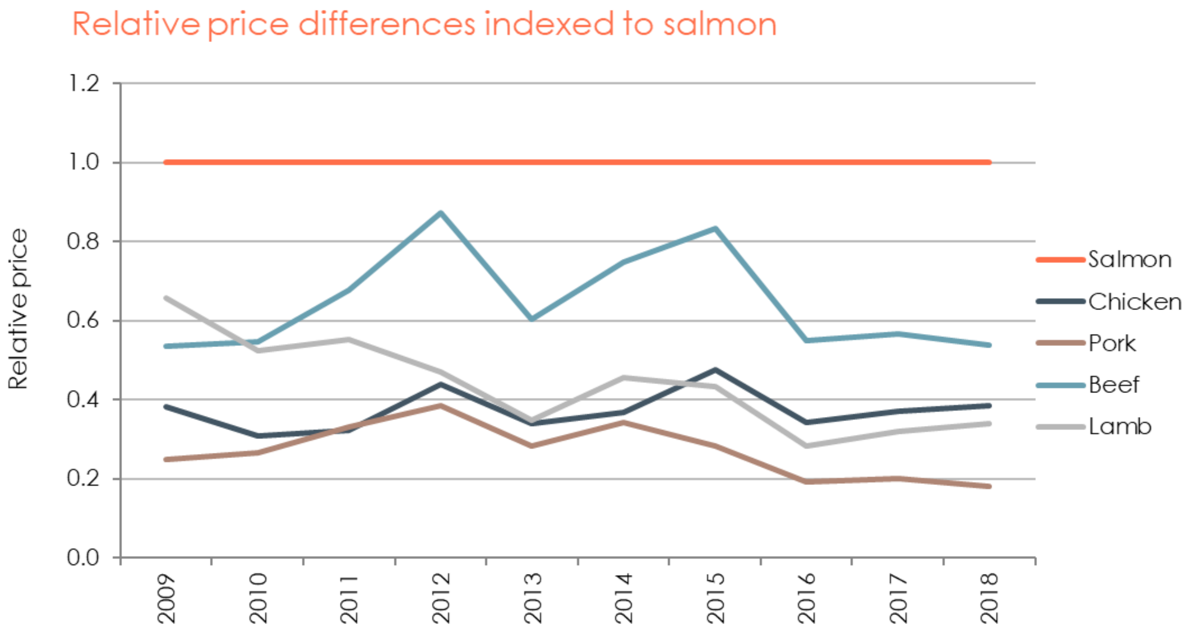
**Total water footprint for farmed salmonid fillets in Scotland, in relation to weight and content of calories, protein and fat.*

Note: 1) The figure reflects total water footprint for farmed salmonid fillets in Scotland, in relation to weight and content of calories, protein and fat .
Source: Mowi, Mekonnen, M.M. & Hoekstra A.Y. (2010), Ytrestøyl et. al. (2014), SINTEF Report (2009) Carbon Footprint and energy use of Norwegian seafood products, IME (2013). SARF. (2014) Scottish Aquaculture's Utilisation of Environmental Resources

3.5 Relative price development of protein products



Along with chicken, beef and pork prices, salmon prices have become relatively more expensive over the last decade.



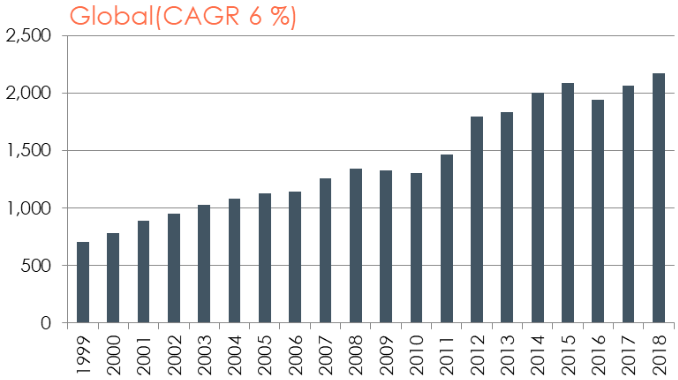
Salmon has historically always been a rather expensive product on the shelves.

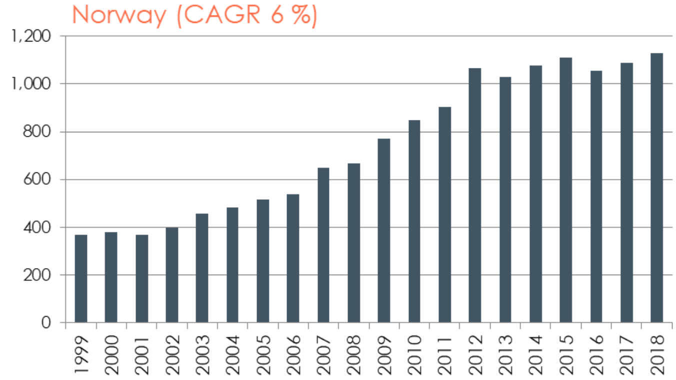
Source: International Monetary Fund

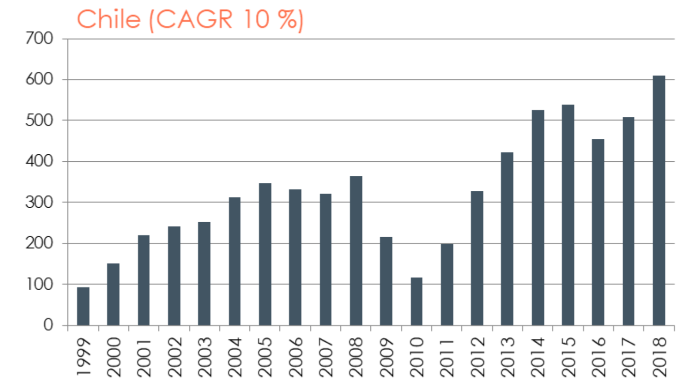
4 Salmon Supply

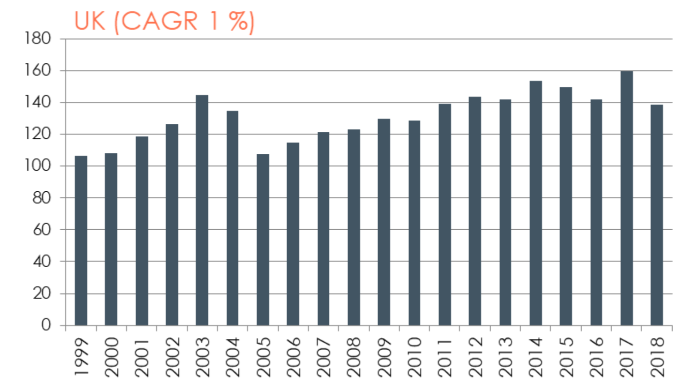
Salmon Supply

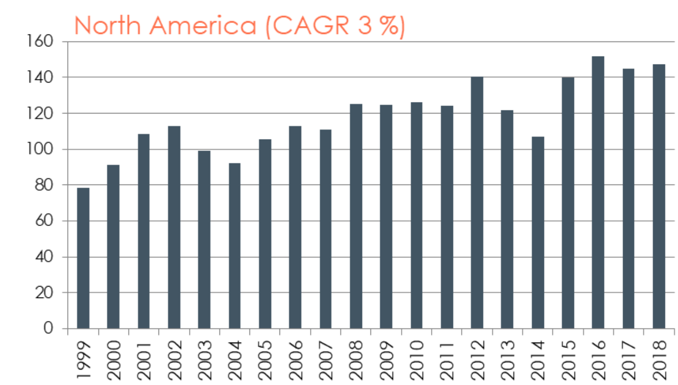
4.1 Total harvest of Atlantic salmon 1999-2018

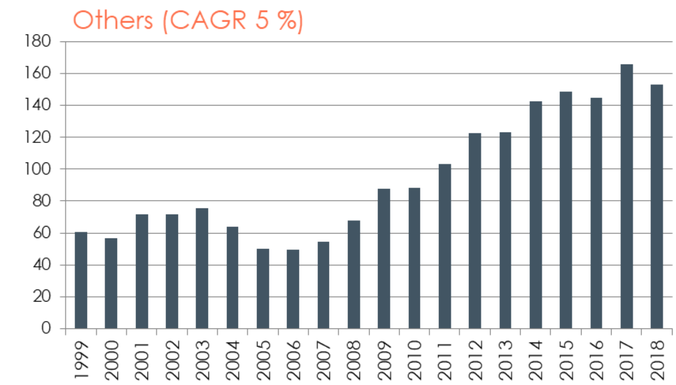








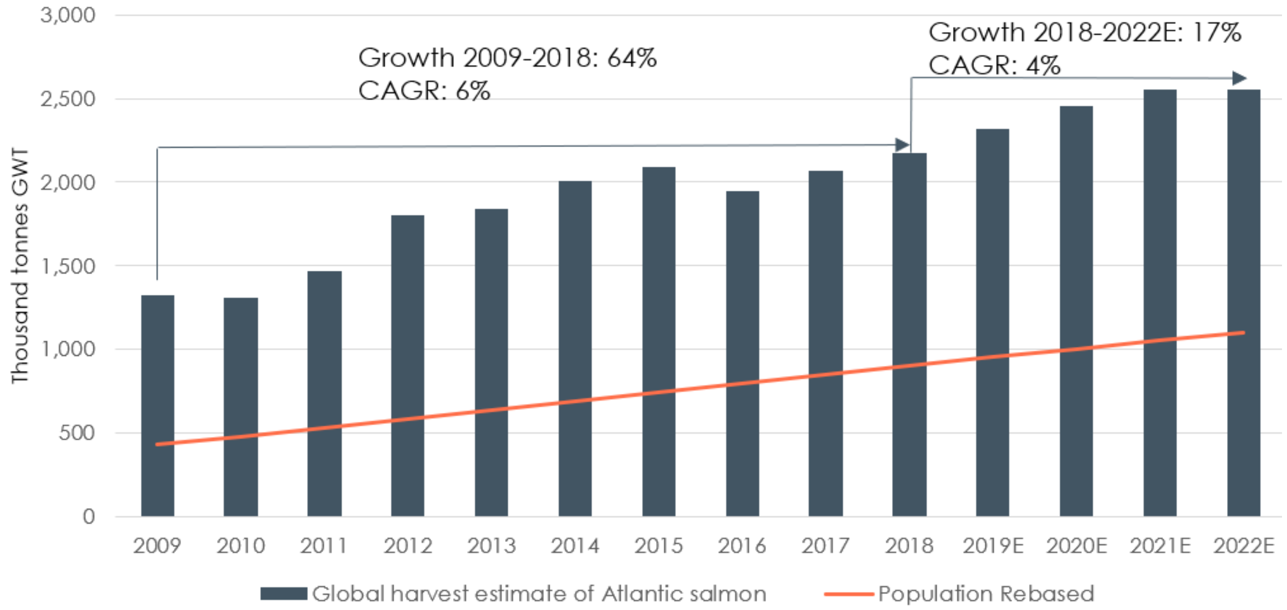




CAGR	Global	Norway	Chile	UK	North America	Others
1999-2018	6 %	6 %	10 %	1 %	3 %	5 %
2009-2018	6 %	4 %	12 %	1 %	2 %	6 %
2018-2022E	4 %	5 %	1 %	6 %	2 %	10 %

Note: Figures are in thousand tonnes GWT and "Others" includes the Faroe Islands, Ireland, Tasmania, Iceland and Russia.
Source: Kontali Analyse

4.2 Diminishing growth expectations



Supply of Atlantic salmon has increased by 443% since 1995 (annual growth of 8%). The annual growth has diminished in recent years with 6% annual growth in the period 2009-2018. Kontali Analyse expects growth to diminish further, and has projected 4% annual growth from 2018 to 2022.

The background for this trend is that the industry has reached a production level where biological boundaries are being pushed. It is therefore expected that future growth can no longer be driven only by the industry and regulators as measures are implemented to reduce its biological footprint. This requires progress in technology, development of improved pharmaceutical products, implementation of non-pharmaceutical techniques, improved industry regulations and intercompany cooperation.

Too rapid growth without these measures in place adversely impacts biological indicators, costs, and in turn output.

Note: Mowi does not provide guidance of industry supply except from guidance depicted in quarterly presentations.
Source: Kontali Analyse, Population Division of the Department of Economic and Social Affairs of the United Nations, World Population Prospects: The 2018 Revision

Salmon Supply

4.3 Few coastlines suitable for salmon farming

The main coastal areas adopted for salmon farming are depicted on the above map. The coastlines are within certain latitude bands in the Northern and Southern Hemisphere.

A key condition is a temperature range between zero and 18-20°C. The optimal temperature range for salmon is between 8 and 14°C.

Salmon farming also requires a certain current to allow a flow of water through the farm. The current must however be below a certain level to allow the fish to move freely around in the sites. Such conditions are typically found in waters protected by archipelagos and fjords and this rules out many coastlines.

Certain biological parameters are also required to allow efficient production. Biological conditions vary significantly within the areas adopted for salmon farming and are prohibitive in certain other areas.

Political willingness to permit salmon farming and to regulate the industry is also required. Licence systems have been adopted in all areas where salmon farming is carried out.

Land based salmon farming (full cycle) has attracted increased investments in the past years. To date, only limited volumes have been harvested on land, however, this could change going forward as new production technologies continue to mature.

5 Sustainable production

Sustainable production

70% of our planet is covered by water, yet the United Nations Food and Agriculture organization (FAO) estimates that only around 2% of the world's food supply comes from the ocean. This includes both farm-raised and wild-caught fish. We know that global consumption of farm-raised seafood will increase in the future, both in terms of overall volumes and as a percentage of the global food supply, for the following reasons:

- The global population is growing at an unprecedented rate.
- The middle class is growing in large emerging markets.
- The health benefits of seafood are increasingly being promoted by global health authorities.
- Aquaculture is more carbon efficient than land-based livestock production.
- The supply of wild fish has limited growth potential.
- Soil erosion necessitates new ways of thinking about how to feed the world.

These global trends offer the seafood industry a unique opportunity to deliver food that is both healthy and sustainable.

Sustainable production

5.1 UN's Sustainable Development Goals

The SDGs which were agreed by all 193 UN member states in 2015 guide governments, civil society and the private sector in a collaborative effort for change towards sustainable development. Out of the 17 SDGs, the industry can contribute significantly to at least ten: good health and well-being, gender equality, decent work and economic growth; reduced inequalities, sustainable cities and communities, industry, innovation and infrastructures; responsible consumption and production; climate action; life below water and partnership for the goals.

Sustainable production

5.2 Sustainability along the supply chain

Salmon farmers are heavily affected by social issues, such as workers' rights and public acceptance of fish farming. Climate change, environmental regulations and certification requirements may have an impact on the supply chain by affecting the availability of both farming areas and raw ingredients used to produce feed. Trade barriers may have a significant impact on our products' availability in different markets.

In turn, the industry has an impact on people and the environment along its value chain. Salmon farmers create jobs and contribute to the economic development of local communities. In addition, the health benefits of our products clearly have a positive impact on people and society in general.

Health and safety issues and labour rights are also key contributors of the social impact industry players have both in their own operations and at their suppliers. Farmers also influence social and environmental standard-setting. In terms of environmental impacts, salmon farmers contribute to greenhouse gas emissions along the supply chain, and affect the local ecosystem in the vicinity of farming operations. However, investment in new technology and infrastructure will lead to more sustainable farming methods that could also be relevant to other fish species.

5.3 Material sustainability topics

Carbon footprint
Fish farming is among the most climate-friendly forms of animal husbandry. The carbon footprint is only 2.9 kg of carbon equivalent per kg of edible product, compared to 5.9 kg of carbon equivalent per edible kg of pork and 30.0 kg per edible kg of beef (SINTEF, 2009).

For the consumer, replacing pork and beef with fish would significantly reduce their personal carbon footprint (daily greenhouse gas (GHG) emissions).

Plastic management
The presence of microplastic in the world's ocean is an emerging issue that fish farmers have started to focus on. Fish farmers are undertaking various initiatives to reduce plastic waste, such as improving waste management, engaging in beach clean-up events around the world, and monitoring the presence of microplastic and plastic-related contaminants in fish.

Escape prevention
Because escaped farm-raised salmon may have a negative impact on the environment due to interactions and interbreeding with wild populations, fish farmers have a target of zero escapes.

Fish health and welfare
Caring about fish welfare is an ethical responsibility. The industry works every day to safeguard the health and welfare of fish through effective sea lice management, and to reduce medicine use by optimizing fish survival and preventing disease.

Biodiversity
The industry needs healthy oceans to drive sustainable salmon farming. Farmers pay attention to the critical and highly sensitive environment.

Sustainable production

5.4 The Global Salmon Initiative & the ASC

Progress in key sustainability topics can be achieved faster by focusing on key partnerships. A number of industry players work closely with the Global Salmon Initiative on transparency and sustainability reporting and on various initiatives linked with ASC certification, non-medicinal approaches to sea lice management and sustainable feed sources. The Global Sustainable Seafood Initiative plays an important role in providing clarity on seafood certification. As part of the Keystone dialogues, Mowi and other key players in the seafood industry have launched a joint global initiative called "Seafood Business for Ocean Stewardship" (SeaBOS).

The Global Salmon Initiative (GSI) is a leadership initiative by global farmed salmon producers, focused on making significant progress towards fully realising a shared goal of providing a healthy and sustainable source of protein to feed a growing population, whilst minimising our environmental footprint, and continuing to improve our social contribution. GSI's focus areas are biosecurity (priority is sea lice), standards (ASC), feed and nutrition (fish meal and oil), and improving industry transparency.

The Aquaculture Stewardship Council (ASC), founded in 2010 by WWF and IDH (Dutch Sustainable Trade Initiative), is an independent non-profit organisation with global influence. ASC aims to be the world's leading certification and labelling programme for sustainably farmed seafood. The ASC's primary role is to manage the global standards for responsible aquaculture.

ASC works with aquaculture producers, seafood processors, retail and foodservice companies, scientists, conservation groups and consumers. The ASC logo sends a strong message to consumers about the environmental and social integrity of the product they are purchasing.

Source: Mowi, www.asc-aqua.org, www.globalsalmoninitiative.org, www.ourgssi.org, keystonedialogues.earth

5.5 Sustainability of fish feed

Over the last two decades, there has been a global trend of growing awareness about the economic, social and environmental aspects of optimal use of fishery by-products, and of the importance of reducing discards. Nowadays, more and more by-products are being used in feed, and a growing percentage of fishmeal is being obtained from trimmings and other residues from the preparation of fish fillets.

According to the UN, 7 million tonnes of wild catch are destroyed or discarded as non-commercial harvest annually by commercial fisheries. This figure could have been converted into an annual fish oil quantity of 0.5 million tonnes, i.e. close to 80% of the tonnage used in salmon and trout farming (UN, 2010).

In FAO's State of World Fisheries and Aquaculture report (2014) it states that in 2012, more than 86% of world fish production was utilised for direct human consumption. The remaining 14% was destined for non-food uses, of which 75% was reduced to fishmeal and fish oil. Although the FAO encourages using more fish directly for human consumption, they are of the opinion that it is more efficient, in a protein-hungry world, to harvest the unmarketable species for animal feed, subsequently consumed by man, than to not harvest the fish at all.

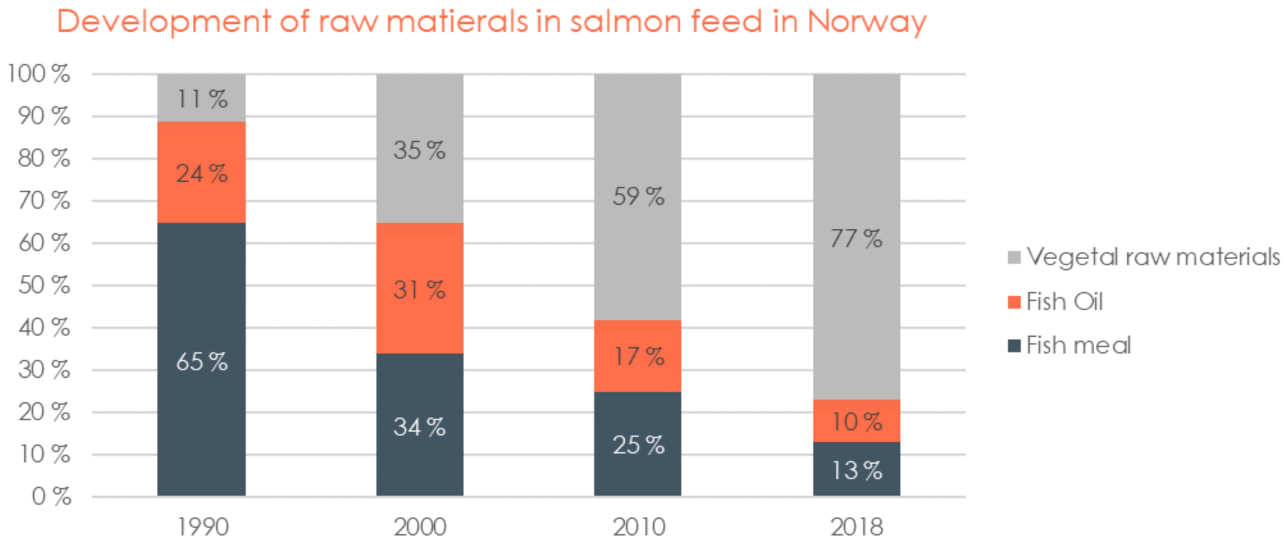
Nonetheless, we have seen a significant decline in the use of fish meal and fish oil in salmon feed due to changes in recipes. While fish meal and fish oil have traditionally been the main ingredients, with reduced availability and increased prices, it is now common practice to substitute these with cheaper and more readily available non-marine raw materials. Fish meal protein is being substituted with plant proteins, such as soya concentrates and sunflower meal or with poultry by-products, such as feather meal (not used in Europe).

A report from Nofima (Ytrestøyl et. al., 2014) shows that the average Norwegian salmon diet in 1990 contained 65% fish meal and 24% fish oil and that this had reduced to 19% and 11% respectively in 2013. Holtermann has estimated the same numbers to be 17% and 9% in 2014. At these low levels, salmon farming is a net producer of marine protein, in others words more fish protein is produced than is used to make the feed. Mowi used 10.3% fish oils and 13.2% fish meal in their salmon feed in 2018.

Source: *Ytrestøyl T., Aas T.S., Åsgård T. (2014) Resource utilisation of Norwegian salmon farming in 2012 and 2013. Nofima report 36/2014 pp. 35, NOFIMA, FAO (2012) World Fisheries and Aquaculture, UN (2010), FAO (2014) World Fisheries and Aquaculture, Holtermann, Mowi*

Sustainable production

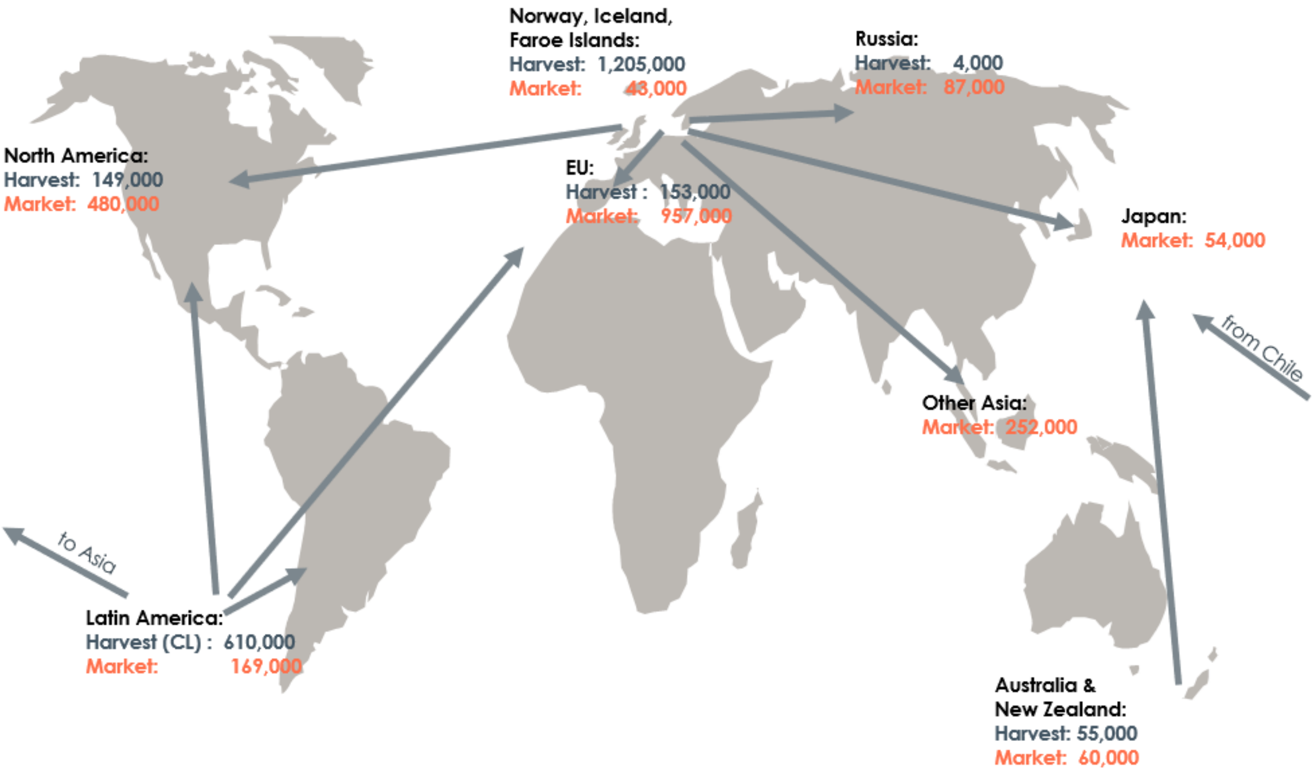
Substitution of marine raw materials has not been found to have any negative effect on growth, susceptibility to disease, or quality of the fish if the fish's own nutrient requirements are being covered. The downward trend in the use of marine ingredients continues and with the ability of Atlantic salmon to utilise alternative feed ingredients, lack of feed raw materials should not be a threat to the growth of the industry. However, there will be increased competition for the best quality raw materials and feed prices may therefore be affected.



6 Salmon Markets

Salmon Markets

6.1 Global trade flow of farmed Atlantic salmon



Historically, the main markets for each production origin have been:

- Norway – EU, Russia (before import-ban in 2014) and Asia
- Chile – USA, South America and Asia
- Canada – USA (west coast)
- Scotland – mainly domestic/within the UK (limited export)

Each producing region has historically focused on developing the nearby markets. As salmon is primarily marketed as a fresh product, time and cost of transportation has driven this trend.

A relatively high price differential is therefore required to justify transatlantic trade as this incurs the cost of airfreight. Such trade varies from period to period and depends on arbitrage opportunities arising from short-term shortages and excess volumes from the various producing countries.

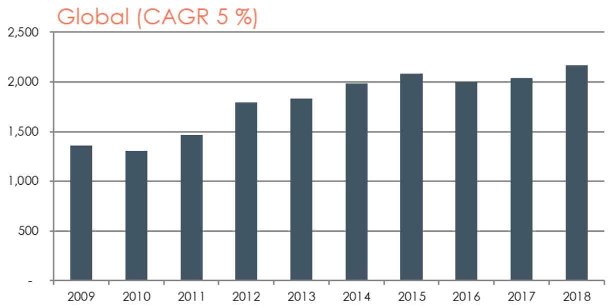
The Asian market is generally shared as transportation costs are broadly similar from all producing regions.

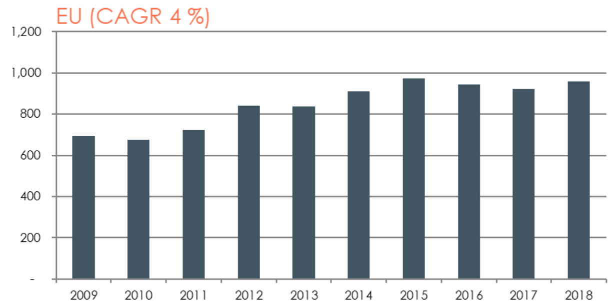
Distribution of frozen salmon is much more straightforward, but this category is decreasing in size.

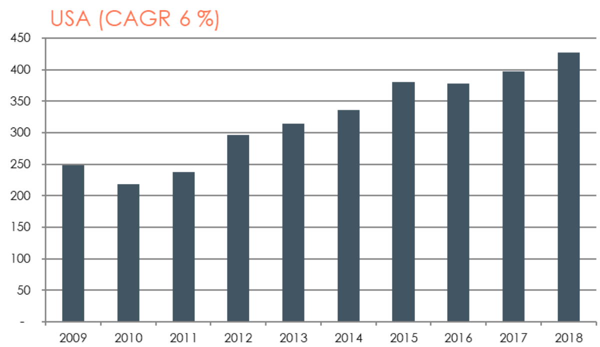
Note: Figures from 2018 and in thousand tonnes GWT. Not all markets are included
Source: Kontali Analyse

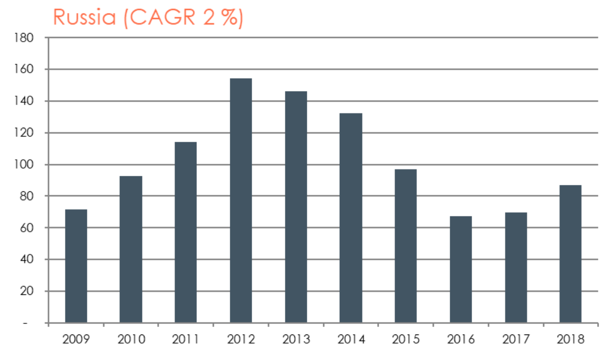
Salmon Markets

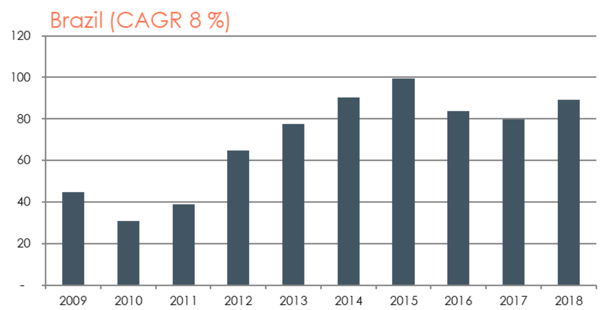
6.2 Farmed Atlantic salmon by market

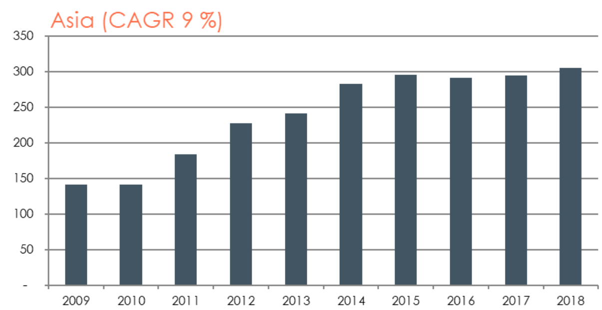










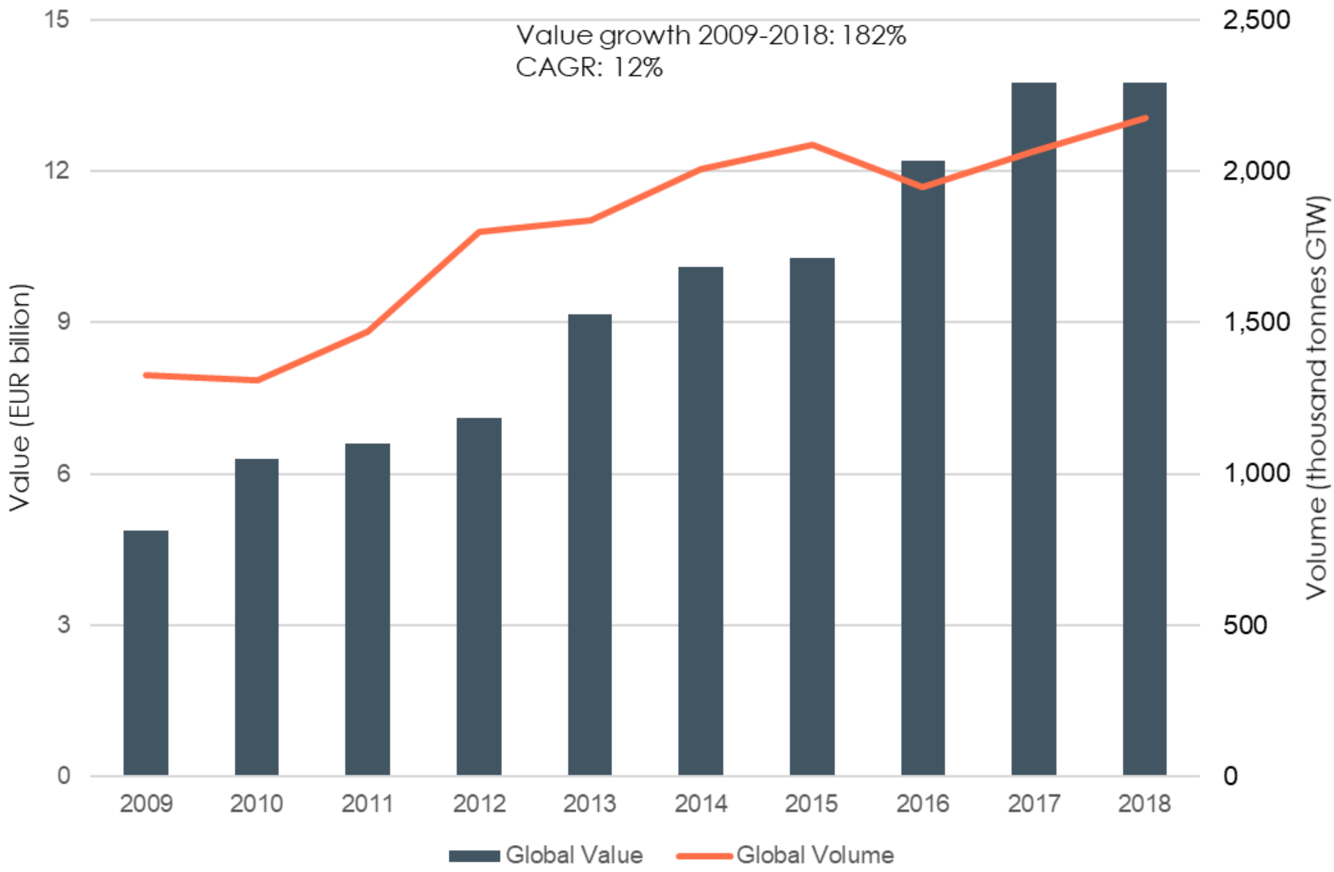


Europe (incl. Russia) and North America are by far the largest markets for Atlantic salmon. However, emerging markets are growing at significantly higher rates than these traditional markets. As all harvested fish is sold and consumed in the market. The market for Atlantic salmon has on average increased by 5.3% in all markets over the last 10 years and by 6% over the last 20 years.

Note: Figures are in thousand tonnes GWT
Source: Kontali Analyse

MOWI

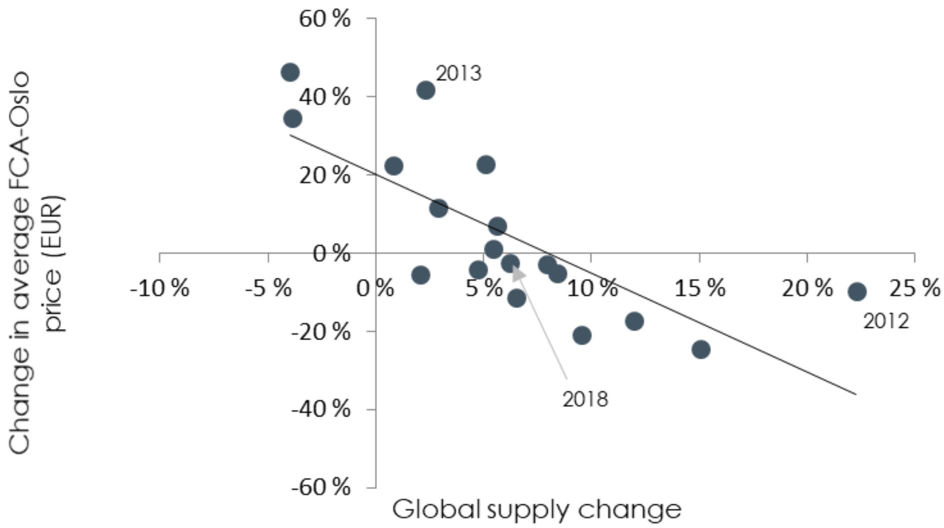
6.3 Development of value vs. volume



The value of salmon sold in 2018 is two times higher than in 2009, while the volume increased by 64% (CAGR 5%) in the same period, illustrating the strong underlying demand for salmon.

Source: Kontali Analyse

6.4 Price neutral demand growth - historically 6-8%



Year	Global supply growth	Change in avg. price FCA Oslo (EUR)
2001	15 %	-25 %
2002	8 %	-3 %
2003	7 %	-11 %
2004	6 %	7 %
2005	5 %	23 %
2006	1 %	23 %
2007	10 %	-21 %
2008	5 %	1 %
2009	3 %	12 %
2010	-4 %	35 %
2011	12 %	-17 %
2012	22 %	-10 %
2013	2 %	42 %
2014	8 %	-5 %
2015	5 %	-4 %
2016	-4 %	46 %
2017	2 %	-5 %
2018	6 %	-2 %

The correlation between change in global supply and average FCA Oslo price (EUR) is very strong. In the period 2000 - 2011, change in supply explained 84% of the change in price using linear regression. In 2011-2012 demand for salmon significantly overperformed.

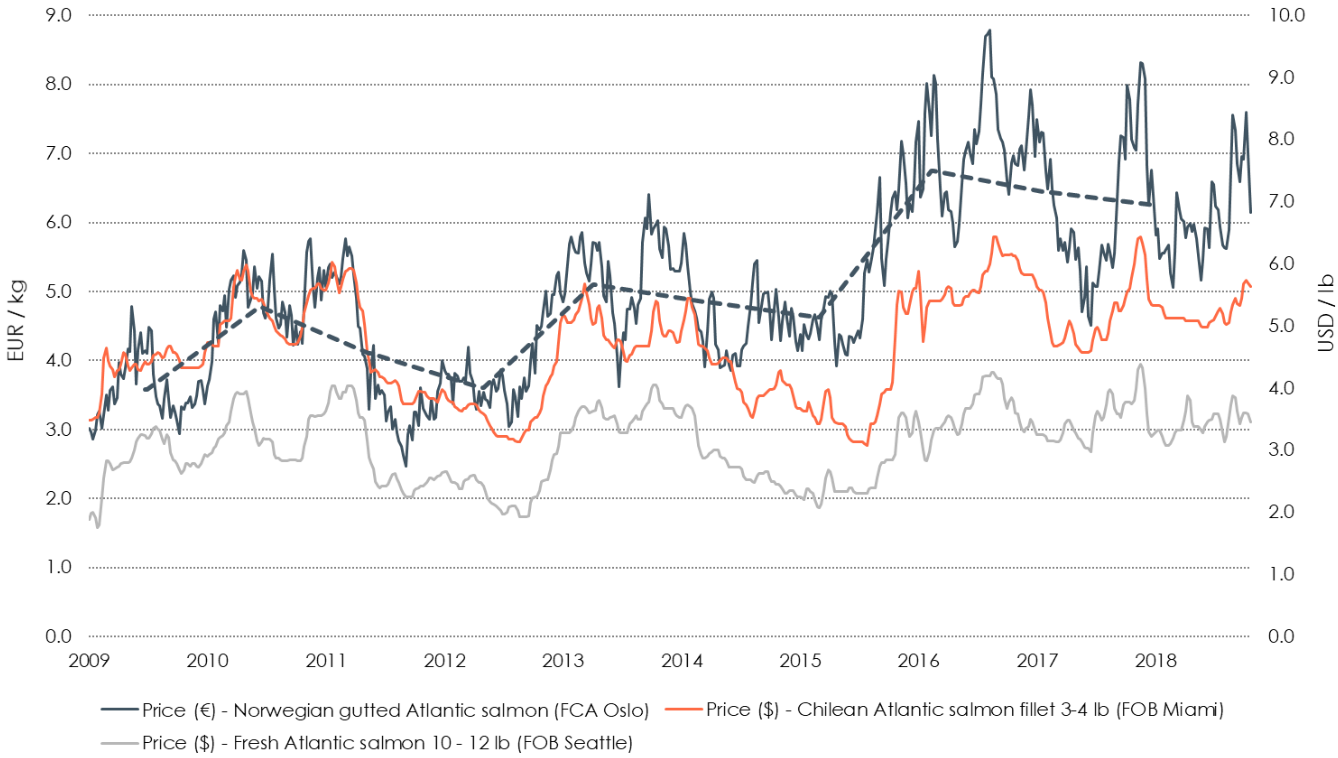
The price correlation across regional markets is generally strong for Atlantic salmon.

Growth in global supply of Atlantic salmon was 180% in the period 2000-2018 (CAGR 6%), varying between -4% and 22% annually. Variation in growth rates has been the main determinant for the variation in prices. Annual average prices have varied between EUR 2.42 (2003) and EUR 6.61 (2016).

Source: Kontali Analyse

Salmon Markets

6.5 Historic price development



As salmon is perishable and marketed fresh, all production in one period must be consumed in the same period. In the short term, the production level is difficult and expensive to adjust as the planning/production cycle is three years long. Therefore, the supplied quantity is very inelastic in the short term, while demand shifts according to the season. This is the main reason for the price volatility of the market.

Factors affecting market price for Atlantic salmon are:
Supply (absolute and seasonal variations)
Demand (absolute and seasonal variations)
Globalisation of the market (arbitrage opportunities between regional markets)
Presence of sales contracts reducing quantity availability for the spot market
Flexibility of market channels
Quality
Disease outbreaks
Food scares

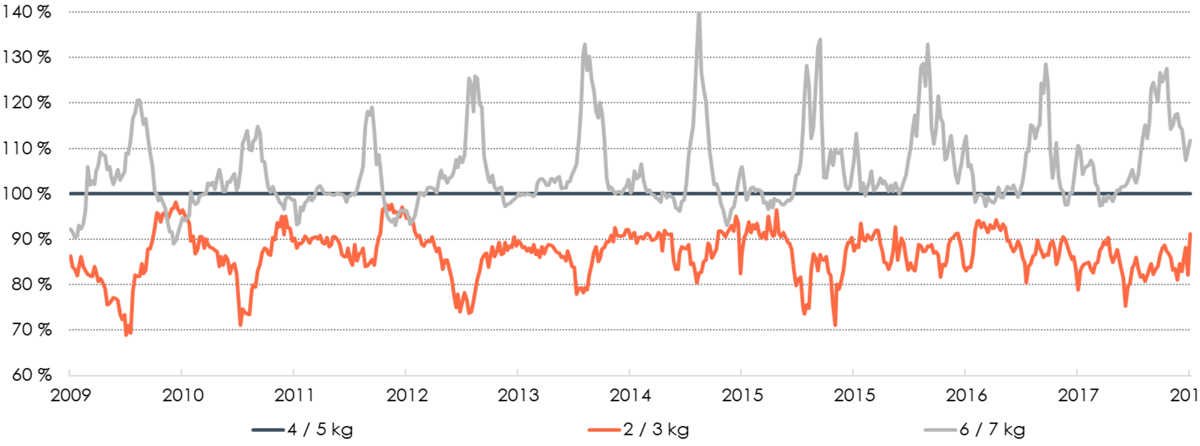
Comparing FCA Oslo, FOB Miami and FOB Seattle, there is a clear indication of a global market as prices correlate to a high degree.

As in most commodity industries, producers of Atlantic salmon experience high volatility in the price achieved for the product. The average price (GWT based) for Norwegian whole salmon since 2009 has been about EUR 5.1/kg (NOK 43.9/kg), for Chilean salmon fillet (3-4lb) USD 4.7/lb (USD 10.3/kg), and for Canadian salmon (10-12lb) USD 3.1/lb (USD 6.8/kg). The pricing of Scottish and Faroese salmon is linked to the price of Norwegian salmon. The price of Scottish salmon normally has a premium to Norwegian salmon. Faroese salmon used to trade at a small discount to Norwegian salmon. However, due to geopolitical events in recent years, salmon from the Faroes now trades at a premium over Norwegian salmon in selected markets.

Source: Kontali Analyse, Nasdaq, Urner Berry. Dotted line represent annual average FCA Oslo

6.6 Different sizes – different prices (Norway)

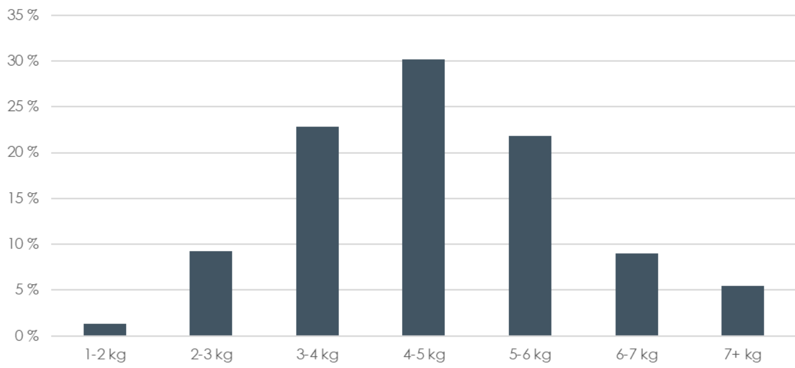
Relative prices



The main reason for differences in size is the biological production process in which individual fish grow at different speeds. A farm holding fish at harvestable size, will show a normally distributed size distribution. This leads to the majority of fish being harvested at 4/5 kg GWT and smaller quantities of smaller and larger fish.

The processing industry in Europe mainly uses 3-6 kg GWT but niche markets exist for small and large fish. As these markets are minor compared to the main market, they are easily disrupted if quantities become too large. Generally, small fish sizes are discounted, and large sized fish are sold at premium as showed in the graph above.

Size distribution



The graph to the left shows Norwegian harvest distribution over the past 6 years, with an average harvest size of 4-5 kg (GWT). In addition to catering for production process and market requirement, another driver behind this size fluctuation is that farmers want to balance out market risk and biological risk. Drivers behind smaller harvest size can be disease, early harvest when there is a need for cash flow, or early harvest to realise ongoing capacity. Larger fish (6-7kg +) may be a result of economies of scale/lower production costs, production for niche markets or other market requirements.

Source: Kontali Analyse

7 Industry Structure

Industry Structure

7.1 Top 5-10 players of farmed Atlantic salmon

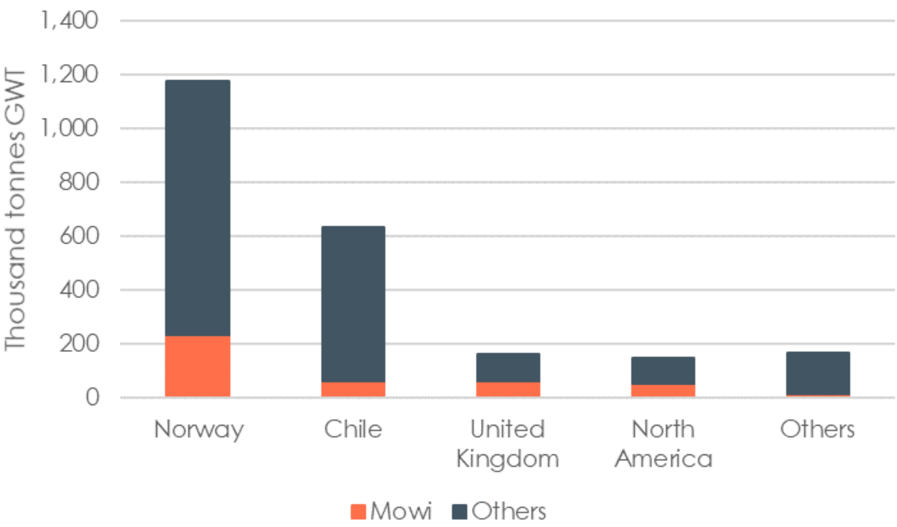
	Top 10 - Norway	H.Q.	Top 5 - United Kingdom	H.Q.	Top 5 - North America	H.Q.	Top 10 - Chile	H.Q.
1	Mowi	230,400	Mowi	38,400	Cooke Aquaculture	60,800	"New Aquachile" (Agrosuper)	109,000
2	Salmar	142,500	The Scottish Salmon Co.	29,900	Mowi	39,300	Mitsubishi / Cermaq	66,000
3	Lerøy Seafood	137,800	Scottish Seafarms	27,500	Mitsubishi / Cermaq	21,800	Salmones Multiexport	64,800
4	Mitsubishi / Cermaq	57,400	Cooke Aquaculture	21,600	Grieg Seafood	16,600	Mowi	53,200
5	Grieg Seafood	46,100	Grieg Seafood	11,900	*		Blumar	47,600
6	Nova Sea	37,900	*				Camanchaca	43,600
7	Nordlaks	36,100					Australis Seafood	34,500
8	Norway Royal Salmon	36,000					Ventisqueros	30,300
9	Sinkaberg-Hansen	27,500					Invermar	20,000
10	Alsaker Fjordbruk	26,000					Marine Farm	19,800
	Top 10	777,700	Top 5	129,300	Top 5	138,500	Top 10	449,000
	Others	350,400	Others	8,900	Others	10,200	Others	160,700
	Total	1,128,100	Total	138,200	Total	148,700	Total	609,700

All figures in tonnes GWT
* The industry in the UK and North America are best described by top 5 and top 4 producers, respectively.

Mowi Group represents the largest total production, harvesting around one fifth of the salmon produced in Norway, and about one third of the total production in North America and the UK.

In Norway and Chile there are several other producers of a significant quantity of Atlantic salmon. In Chile, several of the companies also produce other salmonids, such as Coho and large trout.

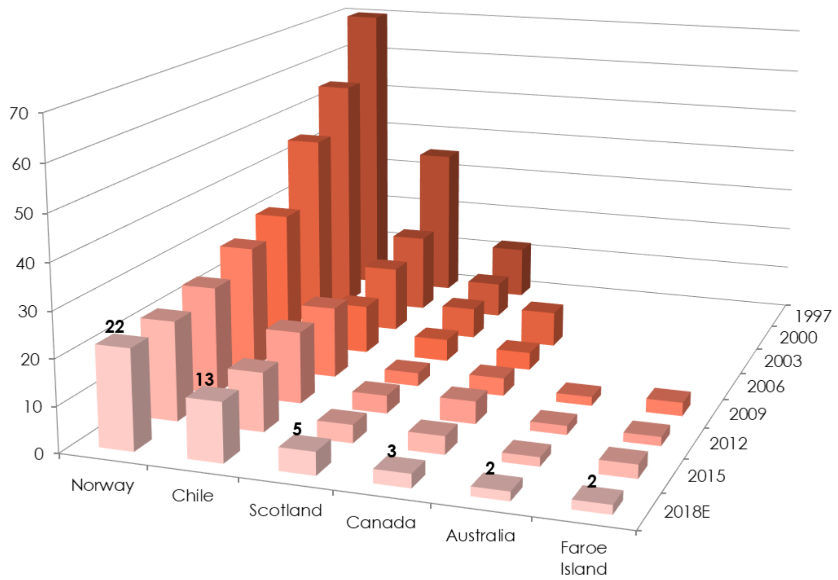
Harvest volume Atlantic Salmon 2019E



Note: 2019E volumes are Mowi's guiding figures
Source: Kontali Analyse, Mowi, Quarterly reports

MOWI

7.2 Number of players in producing countries



The graph shows the number of players producing 80% of the farmed salmon and trout in each major producing country.

Historically, the salmon industry was dominated by several small firms. As illustrated above, it was the case in Norway, and to some extent in Scotland and Chile.

During the last decades the salmon farming industry has been through a period of consolidation in all regions and this is expected to continue.

There are approx. 160 companies owning commercial licences for salmon and trout in Norway, however some of these are controlled by other companies. The total supply is produced by around 100 companies (through themselves or subsidiaries).

There are approximately 1,350 commercial licences for the on-growing of Atlantic salmon, trout and Coho in Chile. Around 90% of these are held by 13 companies with the 10 largest firms accounting for 82% of the total licences. Only between 300 and 350 licences are in operation.

Note: See appendix for some historical acquisitions and divestments
Source: Kontali Analyse

8 Salmon Production and Cost Structure

Salmon Production and Cost Structure

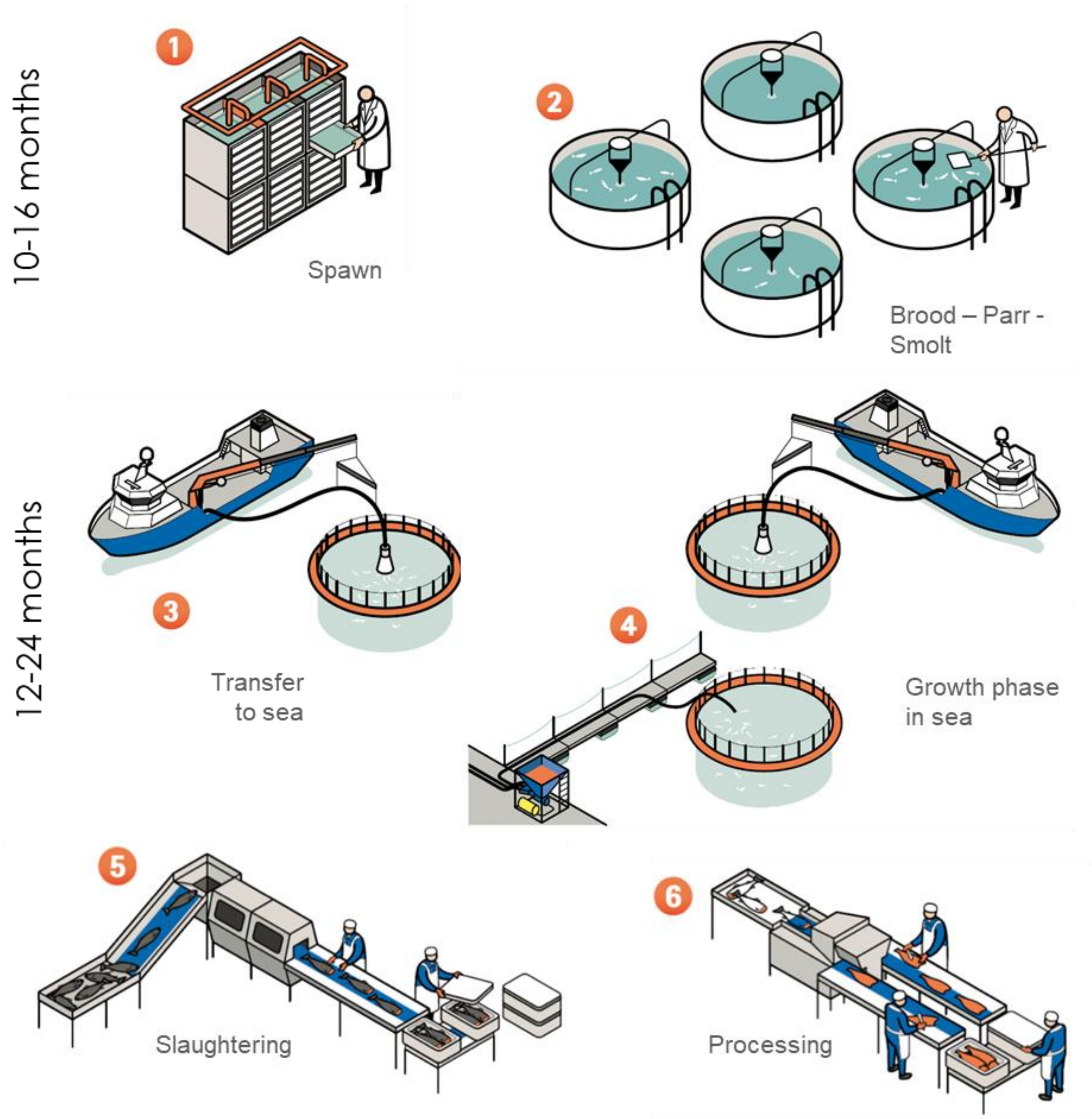
8.1 Establishing a salmon farm

The salmon farming production cycle is about 3 years.
During the first year of production eggs are fertilised and fish are grown to approximately 100-150 grams in a controlled freshwater environment.

The fish are then transported to seawater cages where they are grown to around 4-5 kg over a period of 12-24 months. The growth of the fish is heavily dependent on seawater temperatures, which vary by time of year and across regions.

When they reach harvestable size, the fish are transported to processing plants where they are slaughtered and gutted. Most salmon is sold gutted on ice in a box (GWT).

8.2 The Atlantic salmon life/production cycle



Note: See appendix for more information on the Atlantic salmon production cycle
Source: Mowi

Salmon Production and Cost Structure

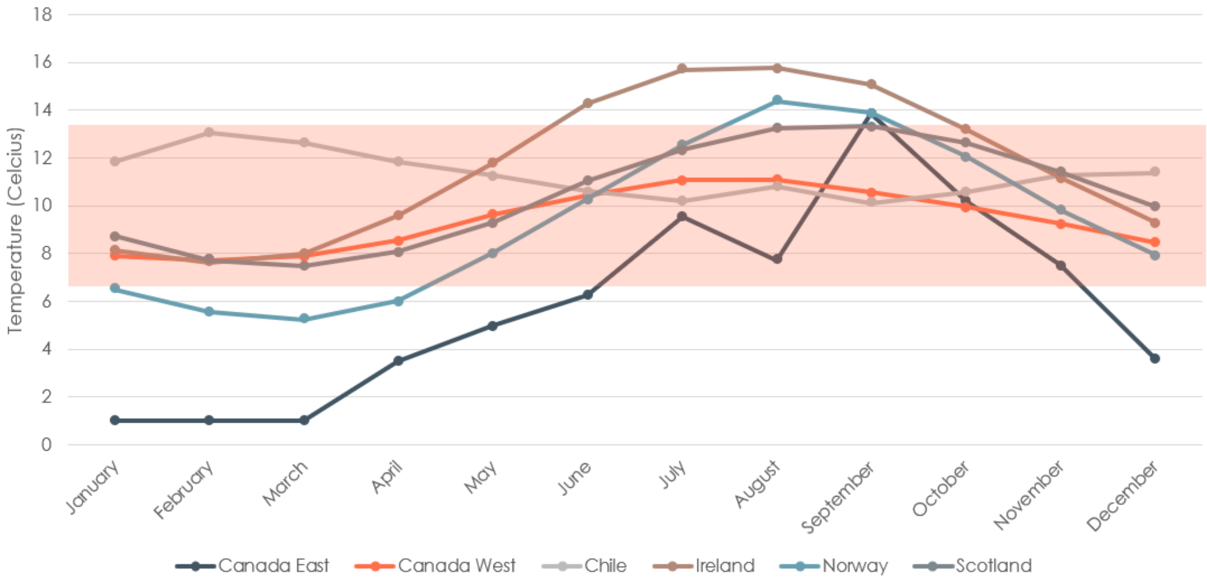
The total freshwater production cycle takes approximately 10-16 months and the seawater production cycle lasts around 12-24 months, giving a total cycle length of on average about 3 years. In Chile, the cycle is slightly shorter as the seawater temperatures are more optimal with fewer fluctuations.

In autumn, the broodstock are stripped for eggs and ova inlay takes place between November and March. The producer can speed up the growth of the juveniles with light manipulation which accelerates the smoltification process by up to 6 months.

In Norway, smolts are mainly released into seawater twice a year. Harvesting is spread evenly across the year, although most harvesting takes place in the last quarter of the year as this is the period of best growth. During summer the harvesting pattern shifts to a new generation, and consequently weight dispersion between large and small harvested salmon is greater at this time than for the rest of the year.

After a site is harvested, the location is fallowed for between 2 and 6 months before the next generation is put to sea at the same location. Smolts may be released in the same location with a two year cycle.

8.3 Influence of seawater temperature



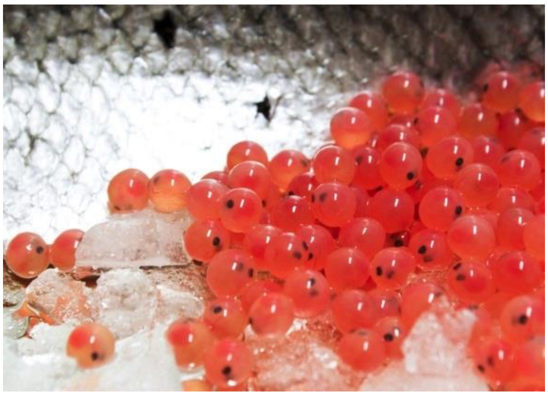
Seawater temperatures vary considerably throughout the year in all production regions. While the production countries in the northern hemisphere see low temperatures during the beginning of the year and high temperatures in autumn varying by as much as 10ºC, the temperature in Chile is more stable varying between 10ºC and 14ºC. Chile has the highest average temperature of 12ºC, while Ireland has 11ºC and the four other regions have an average temperature of about 10ºC.

As the salmon is a cold-blooded animal (ectotherm), water temperature plays an important role in its growth rate. The optimal temperature range for Atlantic salmon is 8-14ºC, but they thrive well from 4-18ºC. Temperature is one of the most important natural competitive advantages that Chile has compared to the other production regions as the production time there historically has been shorter by a few months.

With high seawater temperatures, risk of disease increases, and with temperatures below 0ºC, mass mortality becomes more likely, both of which cause the growth rate to fall.

Source: Mowi
Note: Average temperature 2014-2019 for all regions except Canada East (2018-2019)

8.4 Production inputs



Eggs
There are several suppliers of eggs to the industry. Aquagen AS, Fanad Fisheries Ltd, Lakeland and Salmobreed AS are some of the most significant by quantity. In addition to these suppliers, Mowi produce its own eggs based on the Mowi strain.
Egg suppliers can tailor their production to match demand by obtaining more or less fish for breeding during the preceding season. Production can easily be scaled. The market for salmon eggs is international.

Smolt
The majority of smolt are produced "in-house" by vertically integrated salmon farmers. This production is generally for a company's own use, although a proportion may also be sold to third parties. A smolt is produced over a period of 6-12 months from fertilisation of an egg to a mature smolt weighing 100-250 grams. The post-smolt production (250-1,000 grams) has increased in recent years, accounting for 9% of the smolt release in 2018 in terms of individuals. The idea behind larger smolt is to shorten the time at sea, thus reducing exposure to sea lice, disease etc.

Salmon Production and Cost Structure

Labour
According to The Directorate of Fisheries the Norwegian aquaculture industry employed 7,578 people in 2016. A Nofima report stated that 15,000 people were employed in businesses involved in activities connected with the aquaculture industry in 2013. In total there are over 22,000 people employed full-time either directly or indirectly by the aquaculture industry in Norway.

According to the Scottish Salmon Producers Organisation (SSPO), almost 2,500 people are employed in salmon production in Scotland. The Scottish Government estimates that over 8,000 jobs are generated directly or indirectly by the aquaculture industry.

Estimates on Canadian employment say that around 14,000 people are employed in aquaculture, where Canada's farmed-salmon industry provides more than 10,000 jobs. Direct employment in Chilean aquaculture (including processing) was estimated at around 30,000 people in 2014.

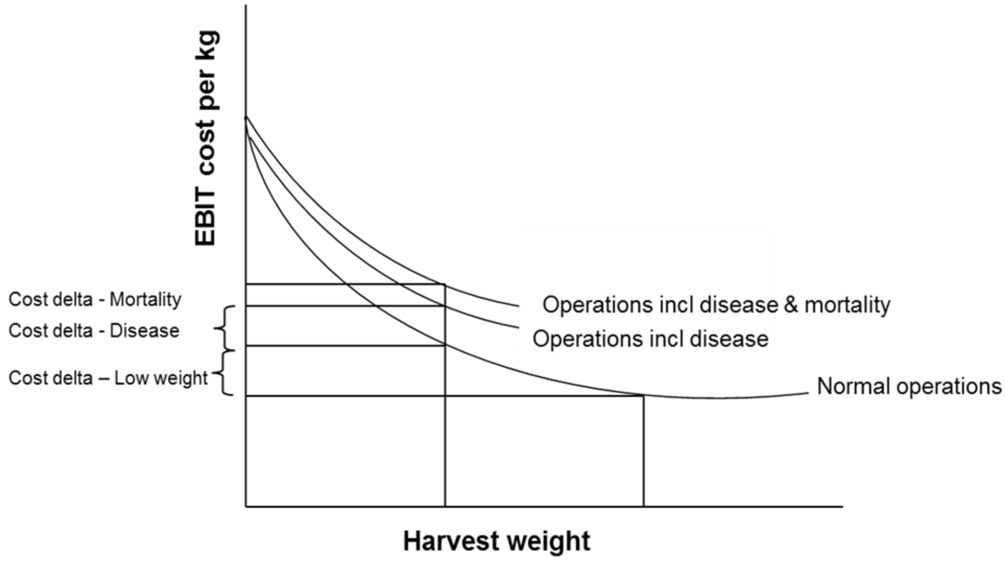
Mowi Group has a total of 14,537 employees in 25 countries worldwide (31 Dec 2018).

In Norway, salaries and levels of automation are highest in the Group, while the opposite is the case in Chile. Salaries in the UK and Canada are lower than in Norway.

Electricity
Electricity is mainly used in the earliest and last stages in the salmon's life cycle. To produce a good quality smolt, production normally takes place in tanks on land where the water temperature is regulated and/or recirculated which requires energy (accounting for 4-5% of smolt cost in Norway). The cost of energy consumption will depend on the price of electricity and the temperature. A cold winter will demand more electricity to heat the water used in the smolt facility. The size of the smolt will also influence electricity consumption as a larger smolt has a longer production cycle in the smolt facility. More energy is consumed when the salmon is processed. However, this depends on the level of automation (2-3% of harvest cost in Norway).

Source: Mowi, Kontali Analyse, Directorate of Fisheries, SSPO, Government of Canada, Estudio Situación Laboral en la Industria del Salmón", Silvia Leiva 2014

8.5 Cost component – disease and mortality



EBIT costs per kg decline with increasing harvest weight. If fish is harvested at a lower weight than optimal (caused by diseases for example), EBIT costs per kg will be higher.

During the production cycle, some mortality will occur. Under normal circumstances, the highest mortality rate will be observed during the first 1-2 months after the smolt is put into seawater, while subsequent stages of the production cycle normally have a lower mortality rate.

Elevated mortality in later months of the cycle is normally related to outbreaks of disease, treatment for sea lice or predator attacks.

There is no strict standard for how to account for mortality in the accounts, and there is no unified industry standard. Three alternative approaches are:
Charge all mortality to expense when it is observed
Capitalise all mortality (letting the surviving individuals carry the cost of dead individuals in the balance sheet when harvested)
Only charge exceptional mortality to expense (mortality, which is higher than what is expected under normal circumstances)

It is not possible to perform biological production without any mortality. By capitalising the mortality cost, the cost of harvested fish will therefore reflect the total cost for the biomass that can be harvested from one production cycle.

8.6 Accounting principles for biological assets

Biological assets are measured at fair value less cost to sell, unless the fair value cannot be measured reliably.

Effective markets for the sale of live fish do not exist so the valuation of live fish implies establishment of an estimated fair value of the fish in a hypothetical market. Fair value is estimated by the use of a calculation model, where cash inflows are functions of estimated volume multiplied with estimated price. Fish ready for harvest (4 kg GWT, which corresponds to 4.8 kg LW) is valued at expected sales price with a deduction of costs related to harvest, transport etc. to arrive at back-to-farm prices. For fish not ready for harvest (i.e. below 4 kg GWT), the model uses an interpolation methodology where the known data points are *i)* the value of the fish when put to sea and *ii)* the estimated value of the fish when it has reached harvest size. The valuation reflects the expected quality grading and size distribution.

Broodstock and smolt are measured at cost less impairment losses, as fair value cannot be measured reliably.

The change in estimated fair value is recognised in profit or loss on a continuous basis and is classified separately (not included in the cost of the harvested biomass). On harvesting, the fair value adjustment is reversed on the same line.

Operational EBIT
Operational EBIT and other operational results are reported based on the realised costs of harvested volume and do not include fair value adjustments on biomass.

8.7 Economics of salmon farming

The salmon farming industry is capital intensive and volatile. This is a result of a long production cycle, a fragmented industry, market conditions and a biological production process which is affected by many external factors.

Over time, production costs have been reduced and productivity has increased as new technology and techniques have improved. In recent years, costs have trended upwards due to several factors including rising feed costs, biological costs and more stringent regulatory compliance procedures.

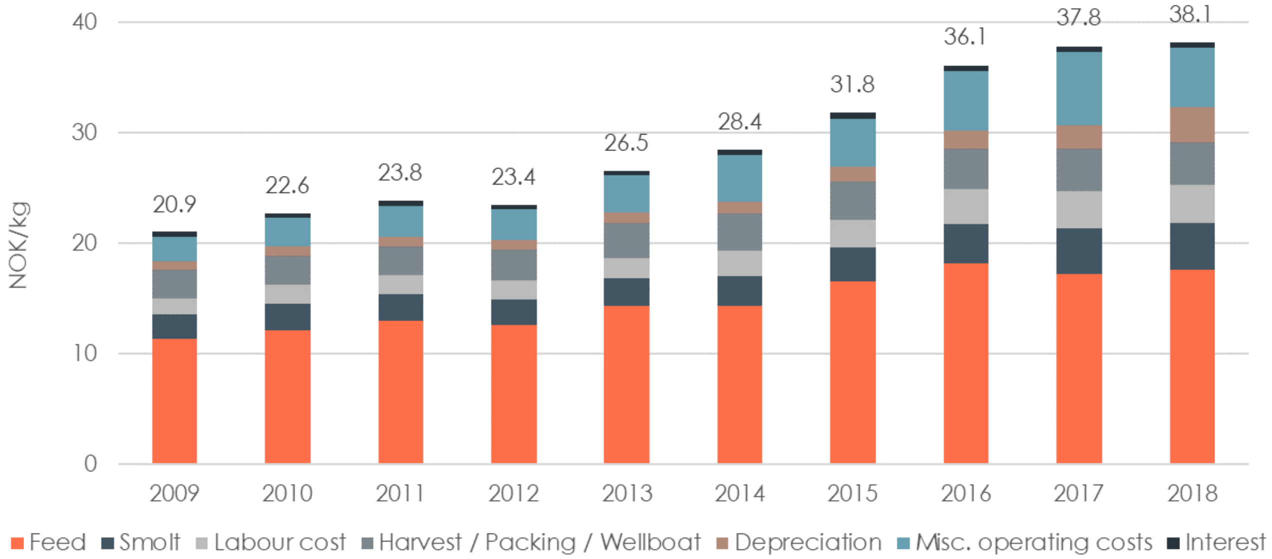
Reported revenues: Revenues are a gross figure; they can include invoiced freight from reference place (e.g. FCA Oslo) to customer, and have discounts, commissions and credits deducted. Reported revenues can also include revenues from trading activity, sales of by-products, insurance compensation, gain/loss on sale of assets etc.

Price: Reported prices are normally stated in the terms of a specific reference price e.g. the Nasdaq price for Norway (FCA Oslo) and UB price for Chile (FOB Miami). Reference prices do not reflect freight, and other sales reducing items mentioned above. Reference prices are for one specific product (Nasdaq price = sales price per kg head on gutted fish packed fresh in a standard box). Sales of other products (frozen products, fresh fillets and portions) will cause deviation in the achieved prices vs. reference price. Reference prices are for superior quality fish, while achieved prices are for a mix of qualities, including downgrades. Reference prices are spot prices, while most companies will have a mix of spot and contract sales in their portfolio.

Quantity: Reported quantity can take many forms. Quantity harvested = Fish harvested in a specific period in a standardized term; e.g. Gutted Weight Equivalent (GWT), which is the same weight measure as Head-on-Gutted (HOG), or Whole Fish Equivalent (WFE), the difference being gutting loss. Quantity sold can be reported using different weight scales:

- Kg sold in product weight.
- Kg sold converted to standard weight unit (GWT or WFE).
- Quantity sold could also include traded quantity.

8.8 Cost structure Norway 2009-2018



Feed: As in all animal production, feed makes up the largest share of the total cost. The variation in costs between countries is based on somewhat different inputs to the feed, logistics and the feed conversion ratio.

Smolt: Atlantic salmon smolt is largely produced at land-based hatcheries either in flow-through or RAS systems. Cost per kilo is increasing as farmers increase the size of the smolt in the hatchery before release to sea. The cost is expected to be offset by shorter time in sea, less lice treatment etc.

Labour Cost: Salmon production is a capital-intensive industry and labour cost accounts for a minor part of total costs. However, it has been increasing over the last years, partly because of increased employment in relation to lice issues.

Harvest/ Packing/ Wellboat: Costs relating to transportation of live fish, slaughtering, processing and packing are all heavily dependent on quantity, logistics and automation.

Depreciation: The industry is investing heavily in new technology and automation, but also in equipment used to treat lice, which in turn leads to higher depreciation costs.

Misc. operating costs: Other costs include direct and indirect costs, administration, insurance, biological costs (excluding mortality), etc.

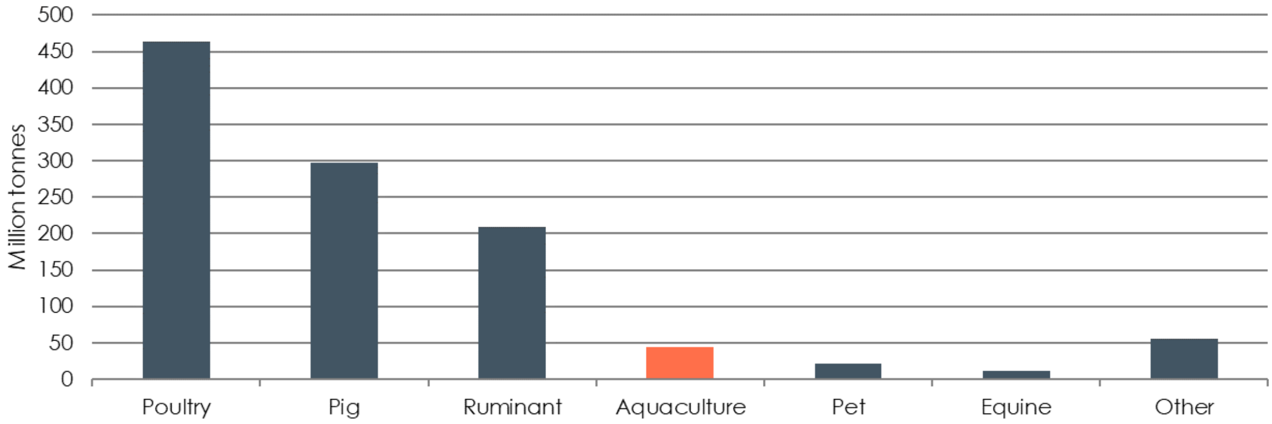
Source: Kontali Analyse. Nofirma (2018) Kostnadsdrivere i lakseoppdrett 2018

9 Feed Production

Feed Production

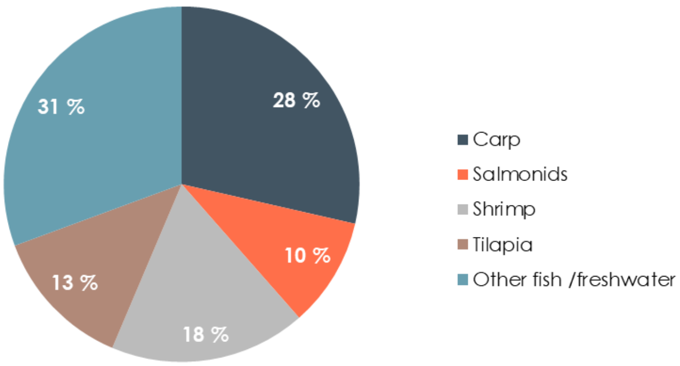
9.1 Overview of feed market

Global production of manufactured feed (2018)



Global production of manufactured feed was around 1,103 million tonnes in 2018. The majority was used for land-dwelling animals, where 88% was used in the farming of poultry, pig and ruminants. Only 4%, or 44 million tonnes, of global production of manufactured feed was used in aquatic farming.

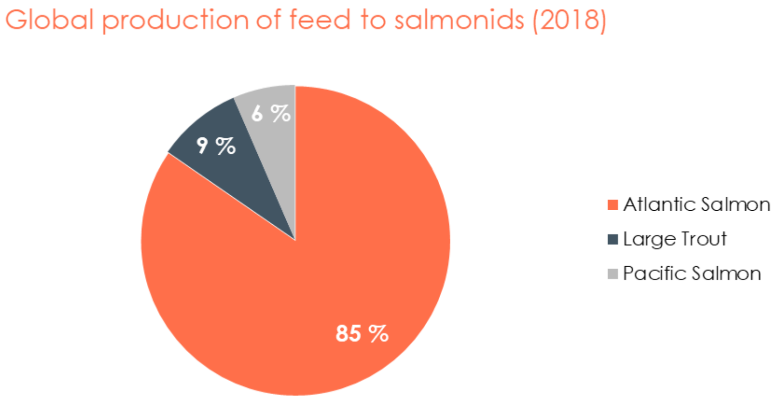
Global production of aquatic feed (2018)



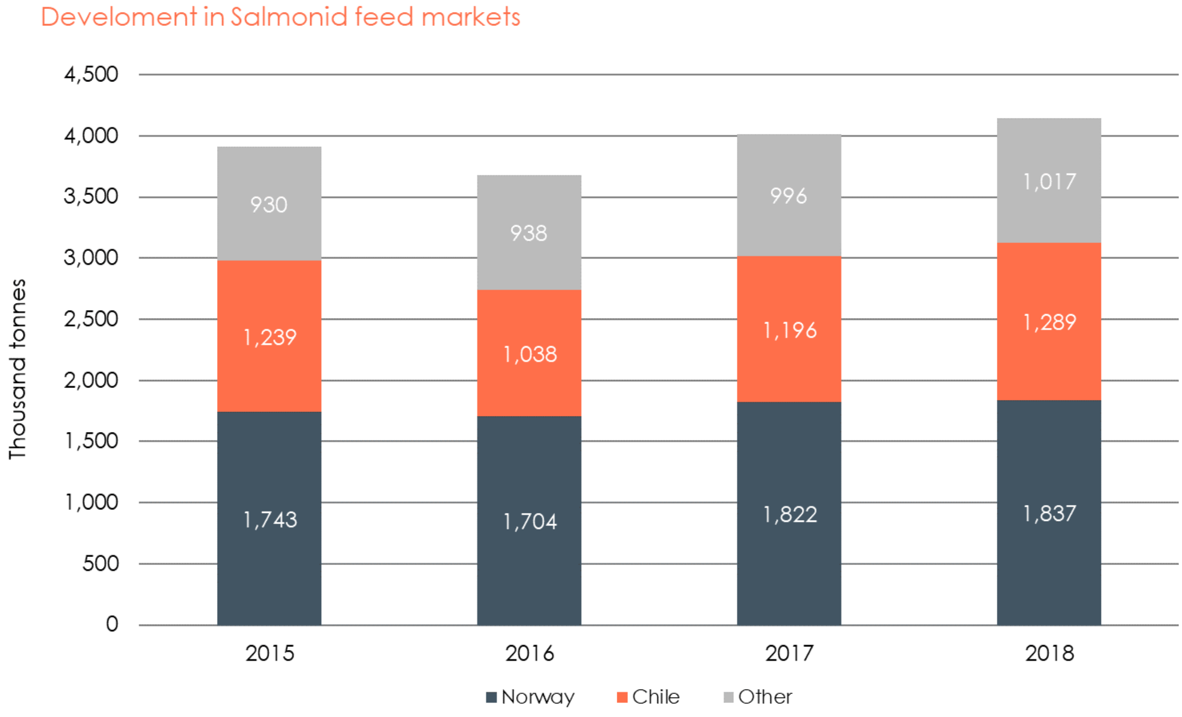
Most aquatic feed produced globally is used for carp as this is the predominant fish species. Feed for salmonids only accounts for 10% of the total production of aquatic feed.

Source: Kontali Analyse

Feed Production



Atlantic salmon is the most farmed species of salmonids and is therefore the largest consumer of salmonid feed.

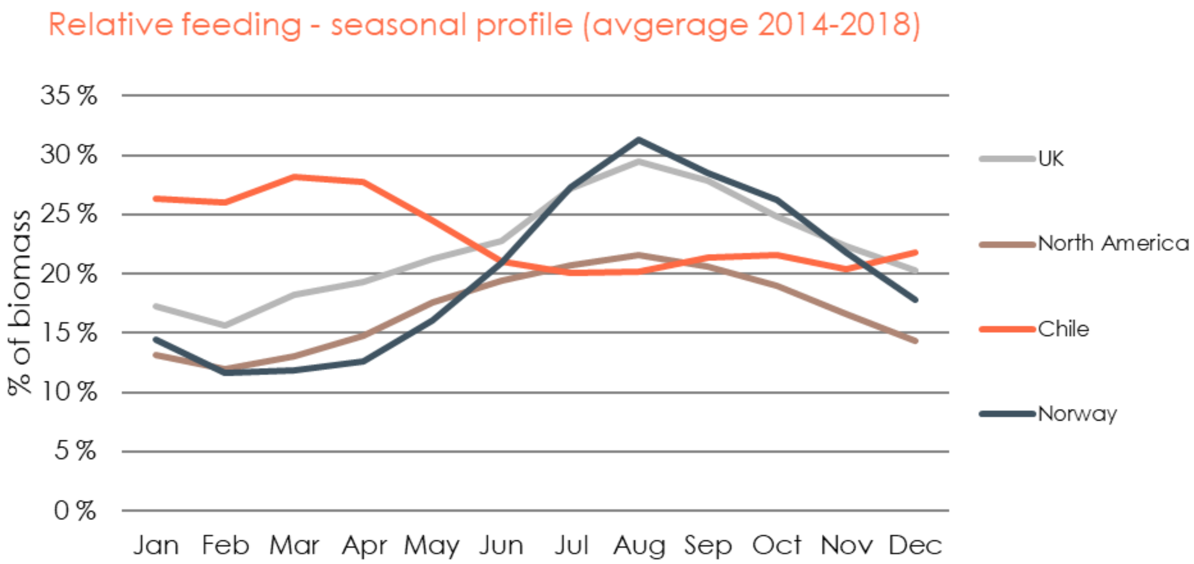


Most of the feed used in farming of salmonids is produced close to where it is farmed. Norway used 44% of the global feed directed towards the salmonid segment in 2018 and Chile used 31%.

Source: Kontali Analyse

Feed Production

9.2 Relative feeding (*)



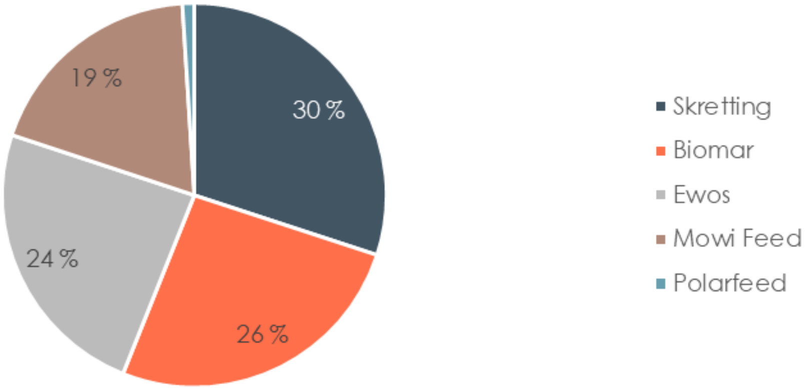
The production of feed around the world varies as there are large deviations in sea temperature. Norway has the greatest seasonality in production. The low season is from February to April and the high season is from July to September, with the mid-season in between. Production in the low season can be as low as only 30% of the high season's production. Feed is considered a perishable product with a shelf life of normally up to a maximum of one year. As the turnover of feed is usually high the shelf life is not considered an issue in large operations.

*Relative feeding: (Feed sold or fed during a month) / (Biomass per primo in month)
Source: Kontali Analyse

Feed Production

9.3 Salmon feed producers

Feed producers market share in Norway 2018E



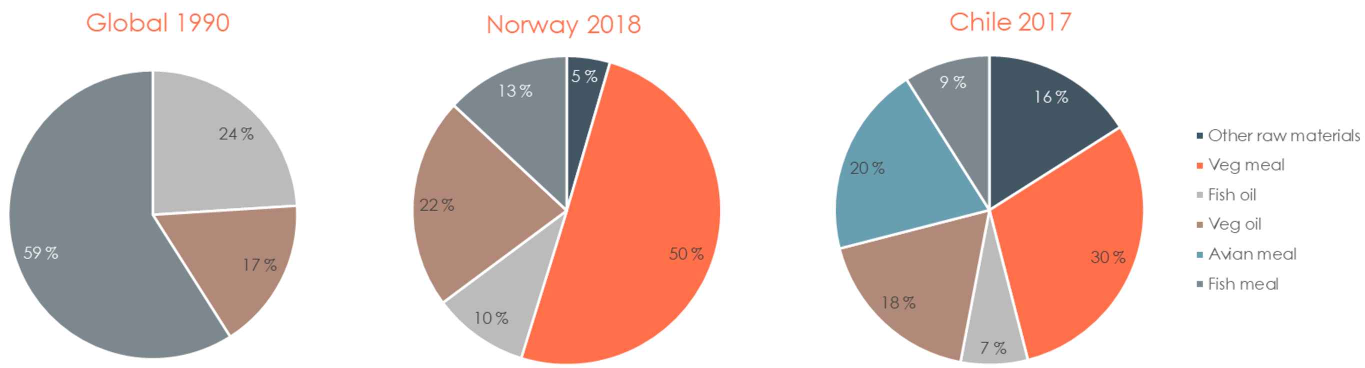
During the last decade, the salmonid feed industry has become increasingly consolidated. Since 2008, three producers have controlled the majority of salmon feed output; Skretting (subsidiary of Nutreco which has been acquired by SHV), Ewos and BioMar (subsidiary of Schouw). The companies all operate globally.

In mid-2014, Mowi began production of feed from its first new feed plant. The plant produced 348,402 tonnes in 2018 compared to a global salmonid feed production of around 4 million tonnes. Mowi's market share more than doubled between the end of 2014 and 2018. In 2019, Mowi completed its second feed plant located in Kyleakin, Scotland and has a capacity of 170,000 tonnes.

The major cost elements when producing salmonid feed are the raw materials required and production costs.

The feed producers have historically operated on cost-plus contracts, leaving the exposure of raw material prices with the aquaculture companies.

9.4 Salmon feed ingredients



Growth intervals	0.1 - 0.2 kg	0.2 - 1 kg	1 - 2 kg	2 - 3 kg	3 - 4 kg	4 - 5 kg
Feed consumption (Norway)	0.08 kg	0.75 kg	1.00 kg	1.05 kg	1.10 kg	1.20 kg
Time, months	2	4	4	3	2	2

Atlantic salmon feeds should provide proteins, energy and essential nutrients to ensure high muscle growth, energy metabolism and good health. Historically, the two most important ingredients in fish feed have been fish meal and fish oil. The use of these two marine raw materials in feed production has been reduced in favour of ingredients such as soy, sunflower, wheat, corn, beans, peas, poultry by-products (in Chile and Canada) and rapeseed oil. This substitution is mainly due to heavy constraints on the availability of fish meal and fish oil.

Atlantic salmon have specific nutrient requirements for amino acids, fatty acids, vitamins, minerals and other lipid- and water-soluble components. These essential nutrients can in principle be provided by the range of different raw materials listed above. Fish meal and other raw materials of animal origin have a more complete amino acid profile and generally have a higher protein concentration compared to proteins of vegetable origin. As long as a fish receives the amino acid it needs it will grow and be healthy and the composition of its muscle protein is the same irrespective of feed protein source. Consequently, feeding salmon with non-marine protein sources results in a net production of marine fish protein.

During the industry's early phases, salmon feed was moist (high water content) with high levels of marine protein (60%) and low levels of fat/oil (10%). In the 1990s, feed typically consisted of 45% protein, made up mostly of marine protein. Today, the marine protein level is lower due to cost optimisation and the availability of fish meal. However, the most interesting development has been the increasingly higher inclusion of fat. This has been made possible through technological development and extruded feeds.

Source: www.nifes.no, Holtermann, Mowi

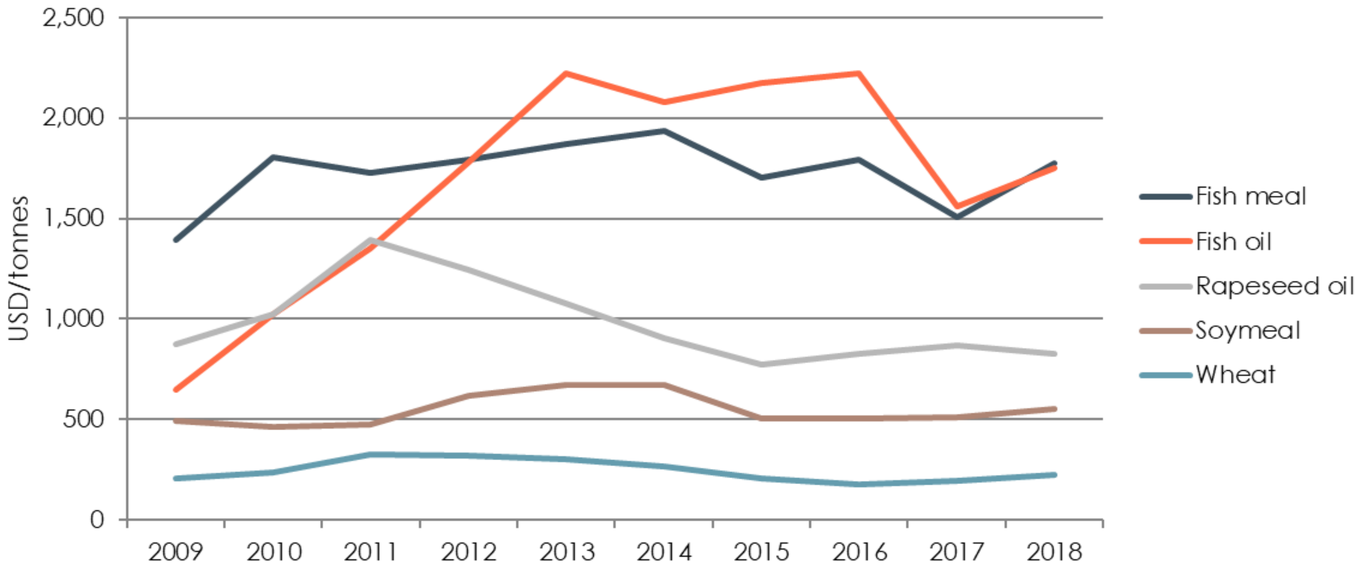
Feed Production

Feed and feeding strategies aim to grow a healthy fish fast at the lowest possible cost. Standard feeds are designed to give the lowest possible production cost rather than maximised growth. Premium diets formulated for the best growth rate are being used in situations where the difference between sales price and production cost make these diets profitable.

Feeding control systems are used at all farms to control and optimise feeding. Feeding is monitored for each net pen to ensure that fish are fed to maximise growth (measured by the Relative Growth Index - RGI). At the same time systems ensure that feeding is stopped immediately when the maximum feed intake has been provided to prevent feed waste. The fastest growing fish typically also have the best (i.e. lowest) feed conversion ratio (FCR).

Feed Production

9.5 Feed raw material market



Fish oil: Since 2009 fish oil prices have increased. The average price of fish oil was about USD 1,750 per tonne in 2018.

Fish meal: Fish meal has also seen an increasing price trend. On average, fish meal has historically been more expensive, but over the last couple of years fish oil has surpassed fish meal in price.

Rapeseed oil: Up until 2011, rapeseed oil and fish oil had correlated price development. However, in the last few years there has been a decreasing trend in the price of rapeseed oil.

Soy meal: Soy and corn have traditionally been very important vegetable protein sources in fish feed. As a consequence of demand from China increasing faster than the increase in soy production and more corn being used for energy purposes, the price of soy meal (and other vegetable proteins) has increased. Parallel to this, there has been an increase in production of genetically modified (GM) soy and corn. Non-GM products have been sold with a premium making them more expensive. The average price in 2018 was USD 554 per tonne.

Wheat: Prices for wheat have remained stable over the years with generally good production and balanced supply/demand.

Source: Holtermann

10 Financial Considerations

Financial Considerations

10.1 Working capital

The long production cycle of salmon requires significant working capital in the form of biomass.

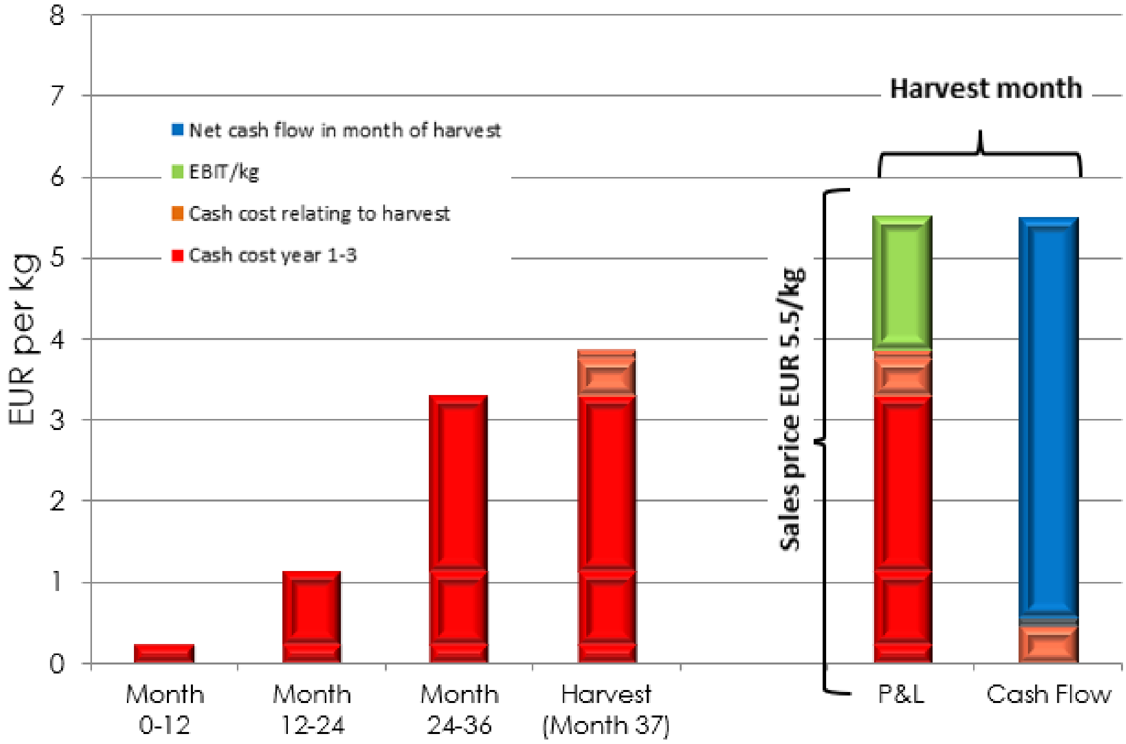
Working capital investments are required for organic growth, as a larger "pipeline" of fish is needed to facilitate larger harvest volumes. On average, a net working capital investment of approximately EUR 3/kg is required, split between the year of harvest and the year immediately preceding harvest, to obtaining an increase in harvest volume of 1 kg. The working capital requirement has increased over time and fluctuates with variations in currency exchange rates.

Net working capital varies during the year. Growth of salmon is heavily impacted by changing seawater temperatures. Salmon grows at a higher pace during summer/autumn and more slowly during winter/spring when the water is colder. As the harvest pattern is relatively constant during the year, this leads to large seasonal variations in net working capital. For a global operator, net working capital normally peaks around year-end and bottoms around mid-summer.

Source: Mowi

Financial Considerations

Cost of building biomass



For illustration purposes, the farming process has been divided into three stages of 12 months. The first 12-month period is from production from egg to finished smolt. 24 months of on-growing in the sea follows this. When the on-growing phase ends, harvest takes place immediately (illustrated as "Month 37"). In a steady state there will always be three different generations at different stages in their life cycle. Capital expenditure is assumed equal to depreciation for illustration purposes. The working capital effects are shown above on a net basis excluding effects from accounts receivables and accounts payables.

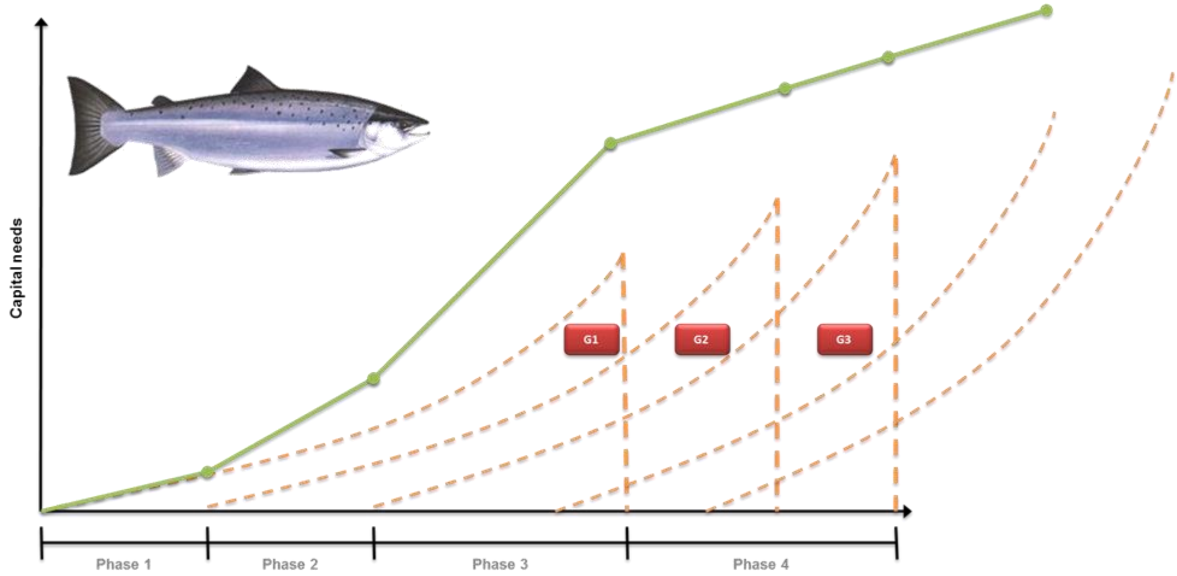
By the point of harvest there have been up to 36 months of costs to produce the fish, comprising the cost of producing the smolt two years ago, further costs incurred to grow the fish in seawater, and some costs related to harvest ("Month 37"). Sales price covers these costs and provides a profit margin (represented by the green rectangle).

Cash cost for the period in which the fish is harvested is not large compared to sales income, creating a high net cash flow. If production going forward (next generations) follows the same pattern, most of the cash flow will be reinvested into salmon at various growth stages. If the company wishes to grow its future output, the following generations need to be larger requiring even more of the cash flow to be reinvested in working capital.

This is a rolling process and requires substantial amounts of working capital to be tied up, both when in a steady state and especially when increasing production.

Source: Mowi

Financial Considerations



The illustration above shows how capital requirements develop when production/biomass is being built "from scratch". In phase 1, there is only one generation (G) of fish produced and the capital requirement is the production cost of the fish. In phase 2, the next generation is also put into production, while the on-growing of G1 continues, rapidly increasing the capital invested. In phase 3, G1 has reached its last stage, G2 is in its on-growing phase and G3 has begun to increase its cost base.

At the end of phase 3, the harvest starts for G1, reducing the capital tied-up, but the next generations are building up their cost base. If each generation is equally large and everything else is in a steady state, the capital requirement would have peaked at the end of phase 3. With a growing production, the capital requirement will also increase after phase 3 as long as the next generation is larger than the previous (if not, the capital base is reduced). We see that salmon farming is a capital-intensive industry.

To equip a grow-out facility you need cages (steel or plastic), moorings, nets, cameras, feed barge/automats and workboats.

Source: Mowi

10.2 Capital return analysis

Investments and payback time (Norway) - assumptions

- Normal site consisting of 4 licenses

- Equipment investment: MEUR 3.5 - 4.5
- Number of licenses: 4
- License cost (second hand market) MEUR: 60 (~MEUR 15 per license)
- Output per generation: ~4,000 tonnes GWT
- Number of smolt released: 1,100,000

- Smolt cost per unit: EUR 1
- Feed price per kg: EUR 1.3 (LW)
- Economic feed conversion ratio (FCR): 1.2 (to Live Weight)
- Conversion rate from Live Weight to GWT: 0.84
- Harvest and processing incl. well boat cost per kg (GWT): EUR 0.4

- Average harvest weight (GWT): 4.5kg
- Mortality in sea: 15%

- Sales price: EUR 5.7/kg

To increase capacity there are many regulations to fulfil.

In this model we focus on a new company entering the industry and have used only one site, for simplicity's sake. Most companies use several sites concurrently, which enables economies of scale and makes the production more flexible and often less costly.

In this model smolts are bought externally, also in the interests of simplicity. Smolts are usually less costly to produce internally, but this depends on production quantity.

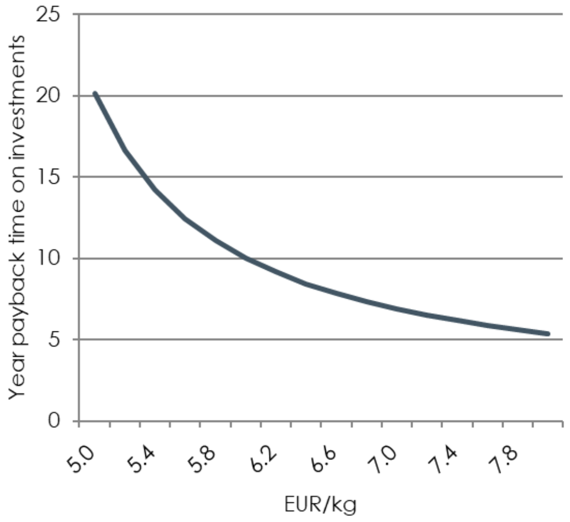
The performance of the fish is affected by numerous factors including feeding regime, seawater temperature, disease, oxygen level in water, smolt quality, etc.

The sales price reflects the average sales price from Norway over the last five years.

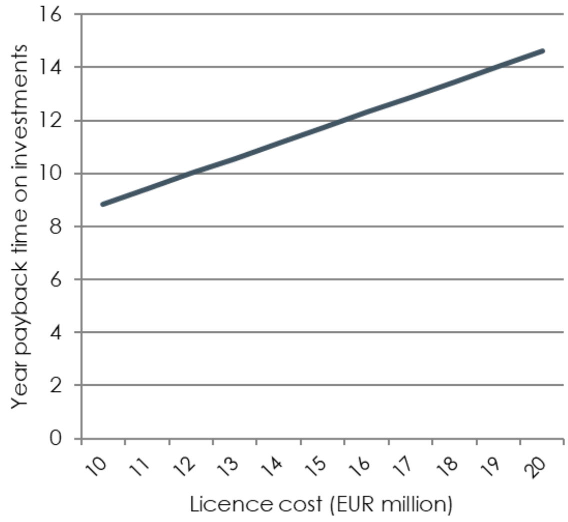
Source: Mowi, Kontali Analyse

Financial Considerations

Payback time varying sales price



Payback time varying licence cost



Results
Because of the simplifications in the model and the low, non-optimal production regime, production costs are higher than the industry average. Due to high entry barriers in terms of capital needs, and falling production costs with increasing quantity, new companies in salmon production will experience higher average production costs. During the production of each generation the working capital needed at this farm, given the assumptions, would be peaking at around MEUR 12 (given that the whole of each generation is harvested at the same time).

With a sales price of EUR 5.7/kg the payback time for the original investments would be around 11.5 years. This result is very sensitive to sales price, licence cost and economic feed conversion ratio (FCR).

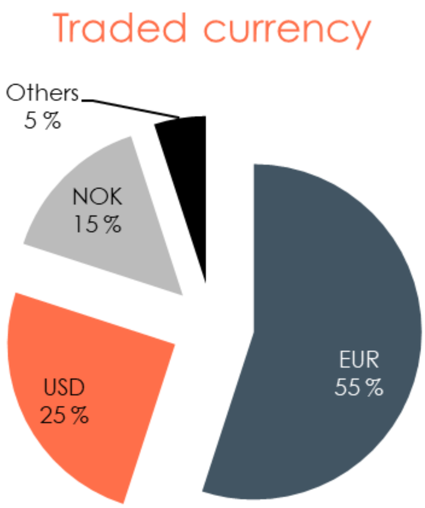
The sales price of EUR 5.7/kg is based on the average price in Norway in the 5-year period 2014-2018.

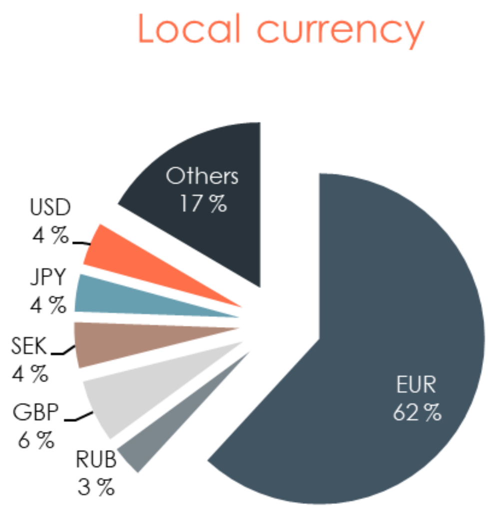
Source: Mowi

Financial Considerations

10.3 Currency overview

Norwegian exposure vs foreign currency[1]





Exporters deal in the traded currency, while the customer has an exposure to both traded and local currencies. For example, a Russian processor trades salmon in USD, but sells its products in the local currency, roubles (RUB).

Most Norwegian producers are exposed to currency fluctuations as most of the salmon they produce is exported. Most of the salmon is exported to countries within the EU and is traded in EUR. The second largest traded currency is USD. Some players in countries in Eastern Europe, the Middle East and some Asian countries prefer to trade salmon in USD rather than in local currency.

The price of salmon quoted in traded currency will compete with other imported goods, while the price of salmon quoted in local currency will compete with the price to consumers of domestically produced products.

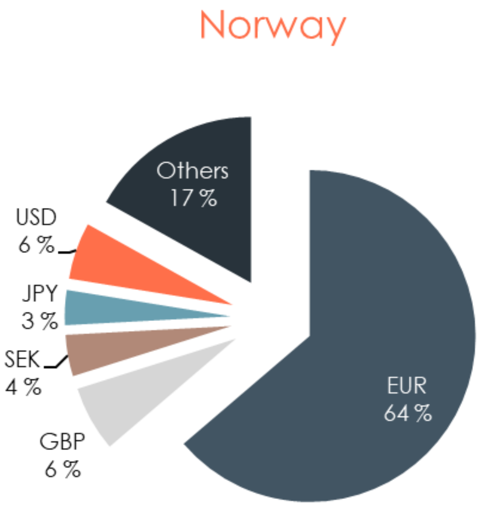
There is a currency risk involved in operating in different currencies, and therefore many of the largest industry players hedge currencies often with back-to-back contracts. The currency risk arising from salmon sales denominated in the traded currency is usually absorbed by the exporter, while the currency risk in local currency is absorbed by the customer.

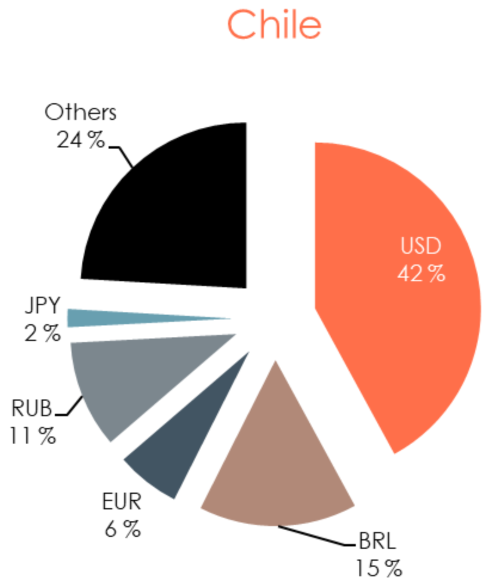
Source: Kontali Analyse

Note: (1) The table shows exposure against local currency weighted against total export volumes

Financial Considerations

Exposure against local currency – 2018[(1)]





Europe is the largest market for Norwegian produced salmon, so EUR is the predominant currency for Norwegian salmon producers. Russia is an important salmon market however, due to the trade sanctions against Russia, Norwegian exposure to RUB is limited. As a result of the sanctions, other markets have recently increased their direct exposure to RUB.

Key markets for Chilean produced salmon are the USA and Brazil, so exposure to USD and BRL (Brazilian real) in local currency terms is followed closely. Exposure to RUB has increased over the years as the Russian market has become more important for Chilean exporters.

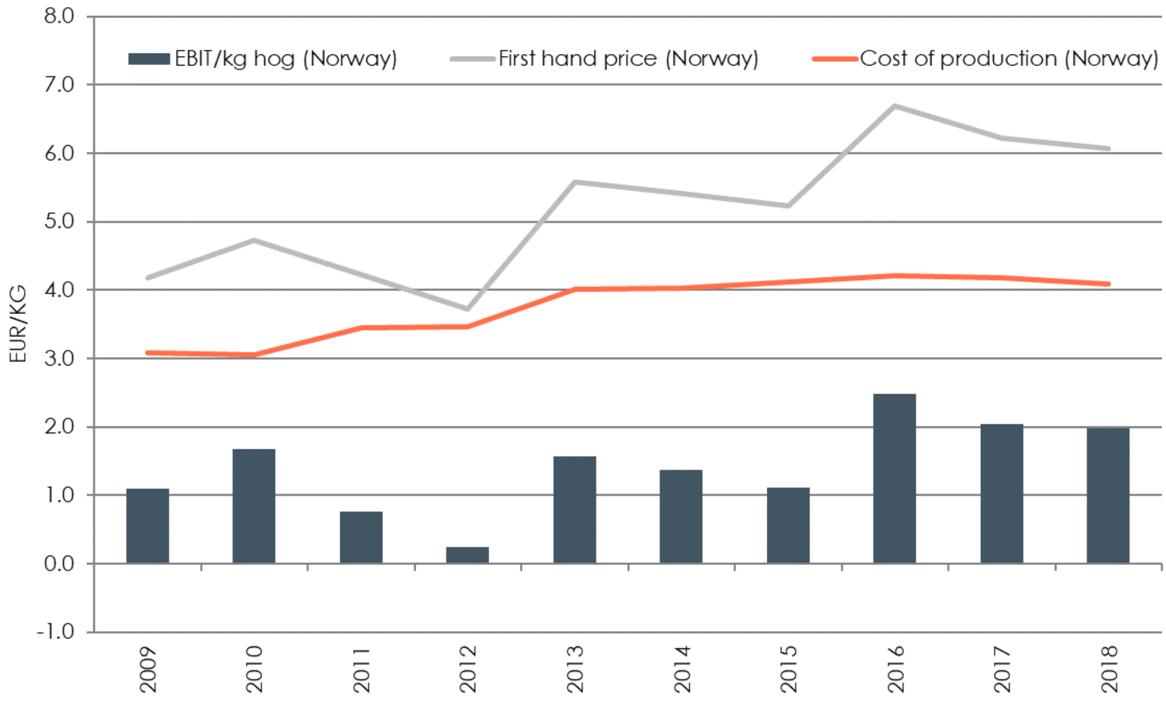
Feed production: Currency exposure
The raw materials required to produce feed are as a rule of thumb quoted in USD (approx. 70%) and EUR (approx. 30%), based on long term average exchange rates. Raw materials generally account for 85% of the cost of producing feed. The remaining costs, including margin for the feed producer, are quoted in local currency.

Secondary Processing: Currency exposure
The biggest market for value added products is Europe, hence the vast majority of currency flows are EUR-denominated, both on the revenue and cost side. In the US and Asian processing markets currency flows are denominated largely in USD and EUR on the revenue side whilst costs are denominated in USD, EUR and local currency.

Source: Kontali
Note:(1) The table shows exposure against local currency weighted against total export volumes

10.4 Price, cost and EBIT development in Norway

Norwegian profitability over time



Adjusted according to KPI (2018 = 100). Price also adjusted for e.g. contract sales.

The upward trending salmon price from 2009-2018 was caused by supply growth being lower than the structural growth in demand. In 2016, an algae bloom in Chile wiped out 100,000 tonnes and at the same time Norway experienced biological challenges which led to high mortality, early harvest and shortage of large fish, which reduced the global supply.

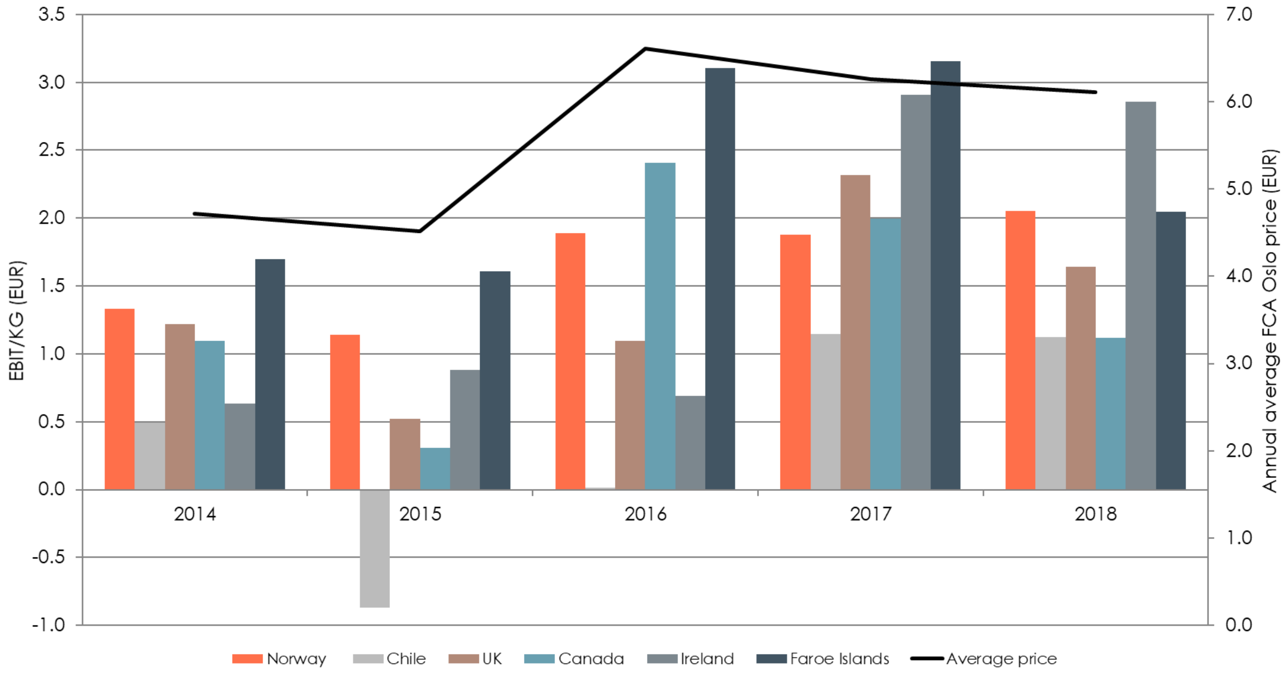
In the last decade product innovation, category management, long-term supply contracts, effective logistics and transportation has stimulated strong demand growth for salmon, in particular in European markets. In recent years, costs have trended upwards due to several factors including rising feed costs, biological costs and more stringent regulatory compliance procedures.
The average EBIT per kg for the Norwegian industry has been positive with the exception of a few shorter periods. The last 10 years it has been EUR 1.4 per kg in nominal terms (EUR 1.8 per kg the last 5 years).

Source: Kontali Analyse, Norges Bank

Financial Considerations

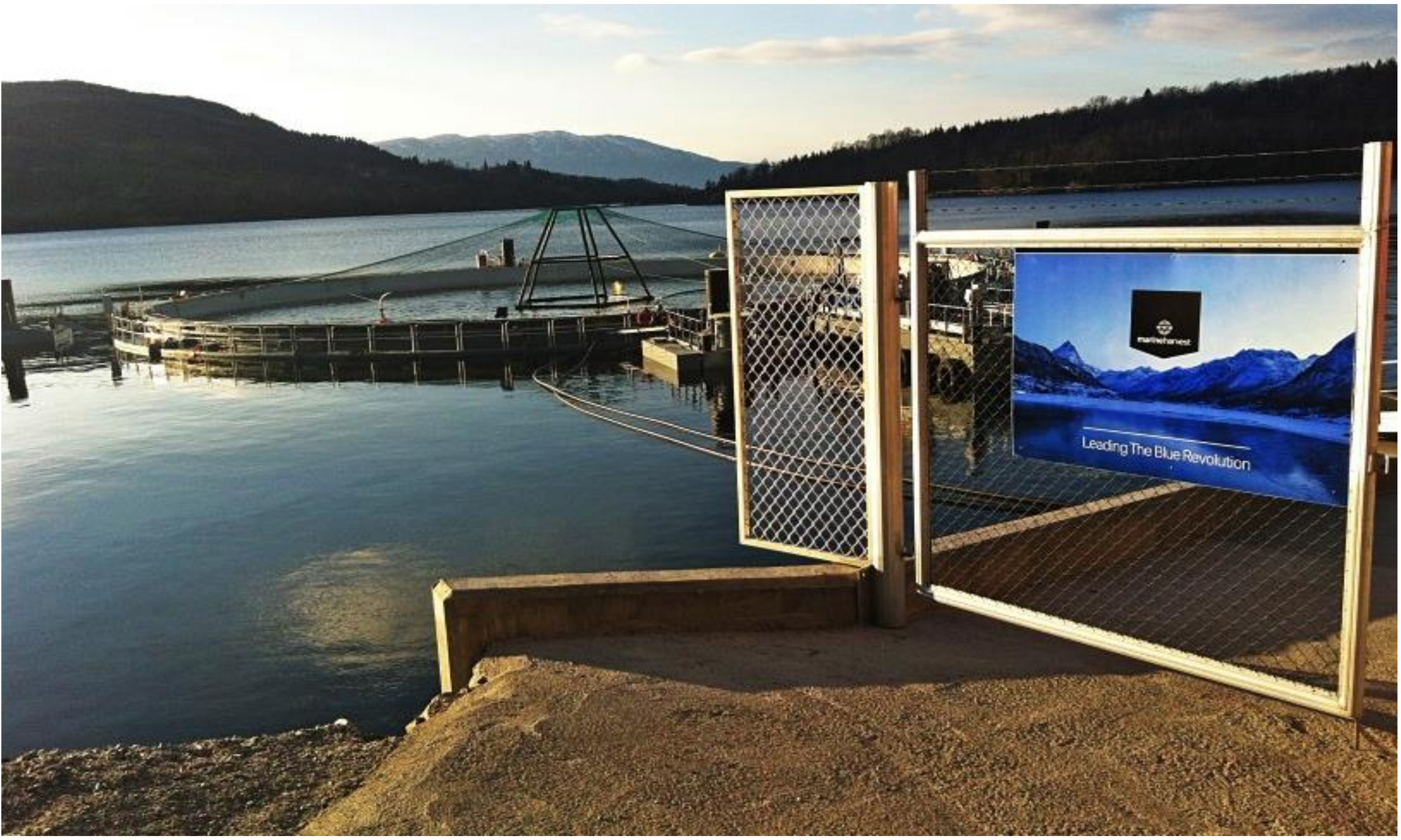
10.5 Effects of geographical diversification

Operational EBIT/KG



The illustration above depicts Mowi's performance across different countries over the last 5 years. In all regions, the biological risk is high, and this impacts cost significantly from period to period. The variance in EBIT per kg is high, however, the geographic specific risk can be diversified with production across regions.

Source: Mowi



11 Barriers to Entry – Licences

Barriers to Entry – Licences

Due to biological constraints, seawater temperature requirements and other natural constraints, farmed salmon is only produced in Norway, Chile, Scotland, the Faroe Islands, Ireland, Iceland, Canada, USA, Tasmania and New Zealand.

Atlantic salmon farming began on an experimental level in the 1960s and evolved into an industry in Norway in the 1980s and in Chile in the 1990s.

In all salmon-producing regions, the relevant authorities have a licensing regime in place. In order to operate a salmon farm, a licence is the key prerequisite. Such licences restrict the maximum production for each company and the industry as a whole. The licence regime varies across jurisdictions.

Barriers to Entry – Licences

11.1 Regulation of fish farming in Norway

Licence and location

Fish farming companies in Norway are subject to a large number of regulations. The Aquaculture Act (17 June 2005) and the Food Safety Act (19 December 2003) are the two most important laws, and there are detailed provisions set out in the various regulations which emanated from them.

In Norway, a salmon-farming licence allows salmon farming either in freshwater (smolt/fingerling production) or in the sea. The number of licences for Atlantic salmon and trout in seawater was limited to 1,041 in 2018. Such limitations do not apply for freshwater licences (smolt production), which can be applied for at any time. Seawater licences in can use up to four farming sites (six sites are allowed when all sites are connected with the same licences). This increases the capacity and efficiency of the sites.

New seawater licences are awarded by the Norwegian Ministry of Trade, Industry and Fisheries and are administered by the Directorate of Fisheries. Licences can be sold and pledged, and legal security is registered in the Aquaculture Register. Since 1982, new licences have been awarded only in certain years.

Production limitations in Norway are regulated as "maximum allowed biomass" (MAB), which is the defined maximum volume of fish a company can hold at sea at all times. In general, one licence sets a MAB of 780 tonnes (945 tonnes in the counties of Troms and Finnmark). The sum of the MAB permitted by all the licences held in each region is the farming company's total allowed biomass in this region. In addition, each production site has its own MAB and the total amount of fish at each site must be less than this set limit. Generally, sites have a MAB of between 2,340 and 4,680 tonnes.

The Norwegian coast is divided into 13 geographical areas of production. The level of sea lice in these areas decide if the MAB can increase (6%), stay the same or decrease (6%) in these areas. Every second year the government announces the conditions for growth on existing and new licences. In 2018 companies in "green" areas were offered a 2% growth on existing licences. The additional 4% growth was part of an open auction.

Sites complying with very strict environmental standards are offered additional growth. The conditions for this growth are A) below 0.1 lice per fish at every counting for the past two years in the period April 1st to September 30th and B) a maximum of one treatment during the last cycle of production. For sites meeting this standard a maximum of 6% growth is offered, regardless of the general situation in the different production areas.

In "red" areas, companies will need to reduce production with 6%. The government is still working on the regulatory details on potential reduction in "red" areas.
In autumn 2019 the government will decide the status of the different 13 areas, based on expert recommendations.

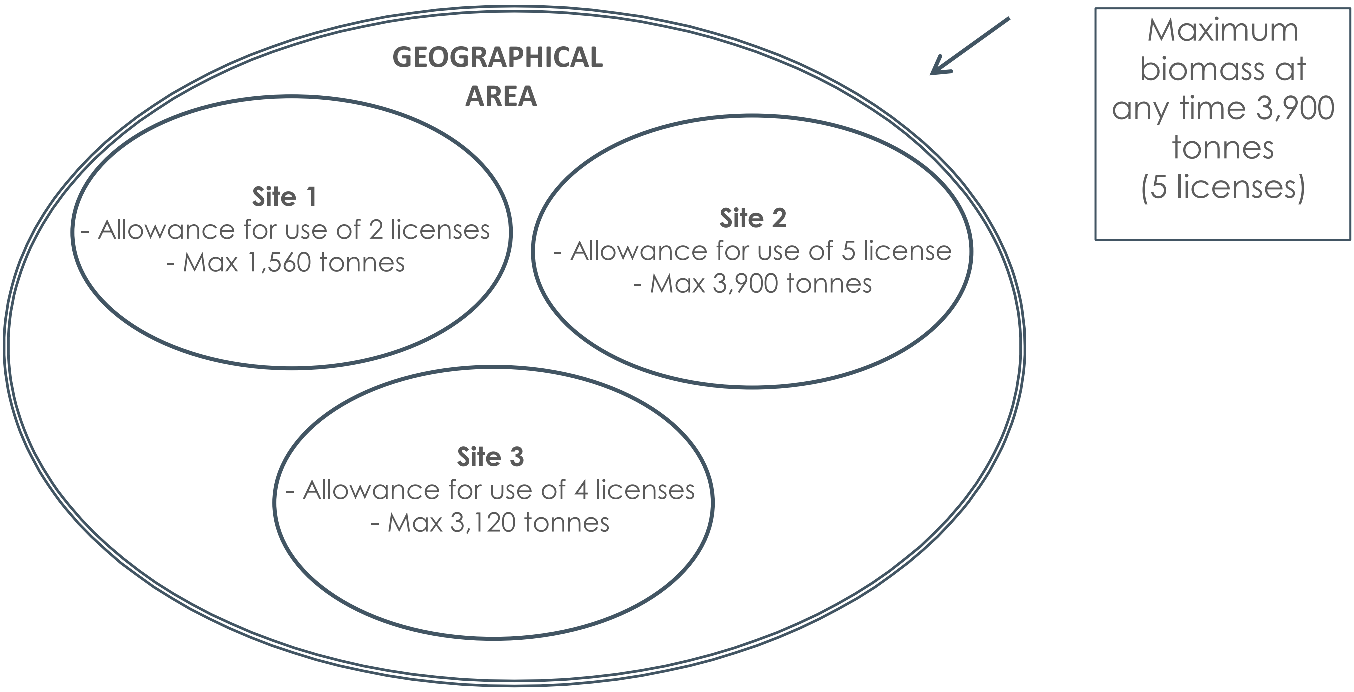
There is an ongoing debate in Norway regarding new taxes aimed at the salmon farming industry. Last year, the Ministry of Finance decided to establish a committee to consider imposing a resource rent tax for the industry. Their recommendation will be public during 2019. So far, several political parties have rejected the proposed new tax, and it is not likely that the Government will impose such a fee, independent of the recommendation from the independent committee.

Barriers to Entry – Licences

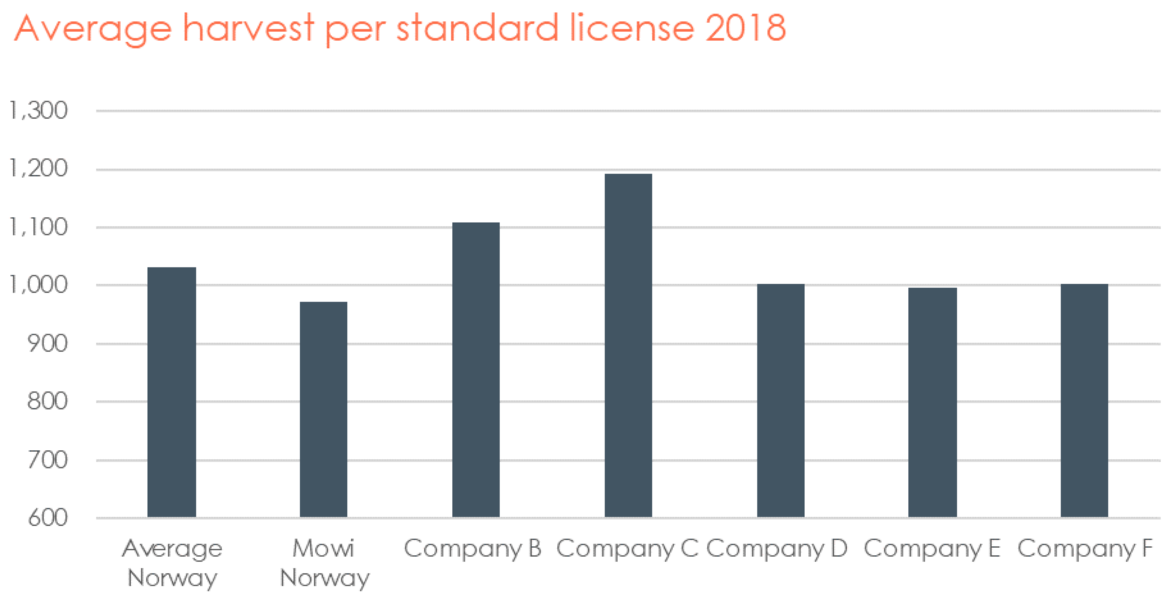
Access to Licences
Until November 2015, a company had to apply for approval from the government if it got control of more than 15% of the total licenced biomass in Norway. Such approval could be given if specific terms regarding the applicant's R&D activity, fish processing and apprenticeships in coastal regions were met. This act on ownership limitation was removed in November 2015.

The figure below depicts an example of the regulatory framework in Norway for one company:

- Number of licences for a defined area: 5
  - Biomass threshold per licence: 780 tonnes live weight (LW)
  - Maximum biomass at any time: 3,900 tonnes (LW)
- Number of sites allocated is 3 (each with a specific biomass cap) In order to optimise the production and harvest quantity over the generations of salmon, the licence holder can operate within the threshold of the three sites as long as the total biomass in sea never exceeds 3,900 tonnes (LW).
- There are also biomass limitations on the individual production sites. The biomass limitation varies from site to site and is determined by the carrying capacity of the site.



Barriers to Entry – Licences



The graph above shows the harvest per licence in 2018 for the Norwegian industry as a whole and for the largest listed companies. The graph is organized by highest harvest quantity.

Please note that one standard licence equates to 945 tonnes MAB in Troms and Finnmark, but 780 tonnes in the rest of the country. Because of this, companies in the North will have a higher utilization per standard licence.

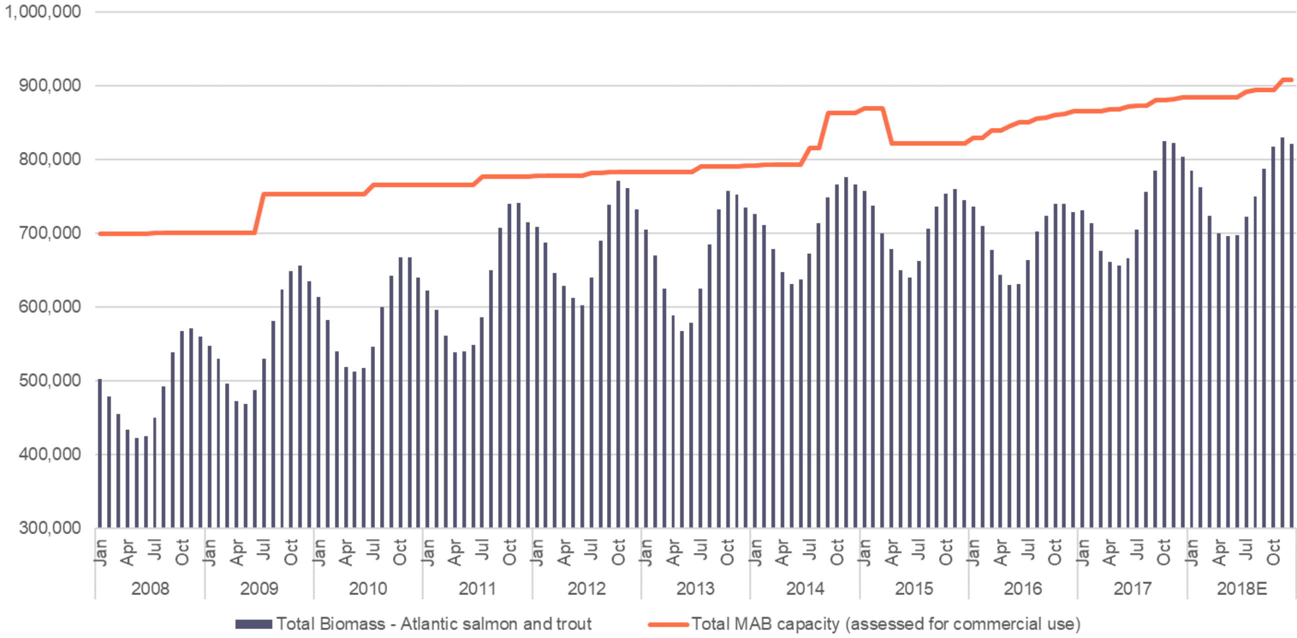
Because of the regulation of standing biomass (maximum allowed biomass - MAB) per licence (780 tonnes LW), the production capacity per licence is limited. Annual harvest quantity per licence in Norway is currently at 1,031 tonnes GWT. Larger companies typically have better flexibility to maximise output per licence which means that the average harvest figure for the industry as a whole is normally lower than the figure for the largest companies.

Number of grow-out seawater licences for salmon and trout in Norway:
2007: 929
2008: 916
2009: 988
2010: 991
2011: 990
2012: 963
2013: 959
2014: 973
2015: 974
2016: 990
2017: 1,015
2018: 1,041

Source: Mowi, Kontali Analyse, Directorate of Fisheries

Barriers to Entry – Licences

Estimated MAB-utilisation in Norway 2008-2018E



Maximum allowed biomass by the end of 2018 was 908,518 tonnes of Atlantic salmon and trout. MAB-utilization is normally at its highest in October-November, because rate of growth is higher than rate of harvest during the summer. It is at its lowest in April-May due to low growth during the cold winter months. Average utilization of the MAB was 85% in 2018E, up from 84% in 2017.

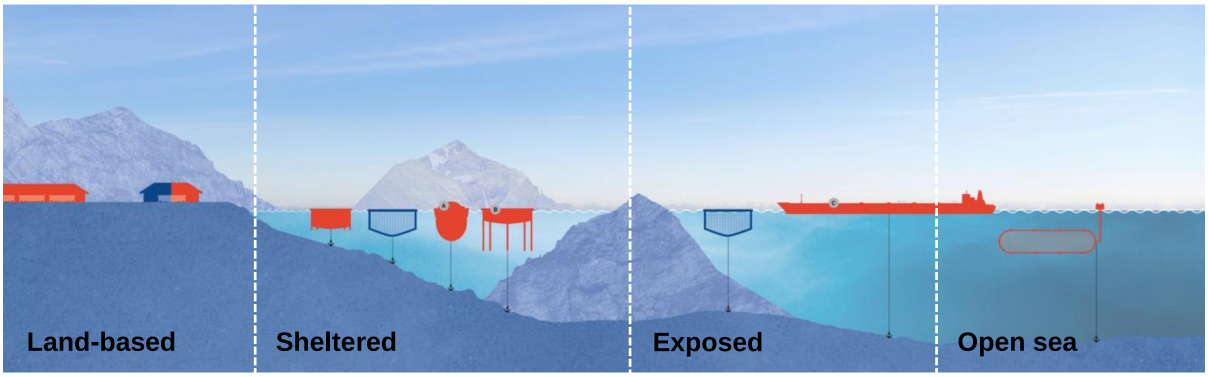
Barriers to Entry – Licences

Closed production in sea
In November 2015 the Norwegian government announced a new category of licence. Development licences are intended to motivate investment into new farming technologies. Development licences are allocated free of charge for up to 15 years. After that, if the project is carried out in line with the set criteria, the licences may be converted into commercial licences at a cost of NOK 10 million.

By the deadline for applications, 104 concept applications had been submitted, out of which 19 have now been approved and 85 denied. The concepts mainly vary in their exposure to the sea; having open or closed structure, and being submerged or unsubmerged solutions.

Mowi applied for a total of 70 licences for five different projects, including three different systems for closed production in sea. The Norwegian Directorate of Fisheries decided that "The Egg" and "Marine Donut" concepts qualified for the development licence scheme. "The Egg" was awarded 6 licences in March 2018 an the "Marine Donut" was awarded 2 licences. The Egg (A) is 44 metres high and 33 metres in diameter, and 90% of the structure will be underwater. The Marine Donut (B) has a volume of 22,000 m3 with high circulation.

The "Back Cage" and "Aqua Storm" concepts have been appealed to the Ministry of Fisheries, and the "Ship" has been rejected by the Ministry of Fisheries.



Source: Directorate of Fisheries

Barriers to Entry – Licences

11.2 Regulation of fish farming in Scotland

Licences and location

In Scotland, instead of a formal licence, permissions are required from four organisations before setting up a fish farming site; Planning Permission from the local Planning Authority, a Marine licence from Marine Scotland; an environmental licence from the Scottish Environment Protection Agency (SEPA) and an Aquaculture Production Business authorisation, also from Marine Scotland. The Maximum Allowed Biomass (MAB) for individual sites is determined based on an assessment of environmental concerns, including the carrying capacity of the local marine environment to be able to accommodate the fish farm. As a consequence, MAB for salmon farms is not uniform and varies; at present up to a maximum of 2,500 tonnes depending on site characteristics and geographic location. The availability of improved environmental modelling tools and a proposed revision to SEPA's regulatory framework during 2019 will now allow licences to be issued for MAB > 2,500 tonnes.

The Crown Estate owns and manages most of the seabed around the UK out to a distance of 12 nautical miles. Anyone who develops or operates in UK territorial waters is doing so on Crown Estate property. Because of this, you have to apply for a lease from The Crown Estate and pay rent to install and operate your farm on the seabed. Most existing licences are automatically renewed at the end of their lease period. A Crown Estate lease is generally granted for a period of 25-year period and is dependent on securing Planning Permission.

The environmental licence from SEPA can be reviewed and MAB reduced in the event of non-compliance with environmental standards and potentially revoked in cases of significant and long-term non-compliance.

New site applications can take 6 months for planning permission to be granted with the determination period for applications for the environmental licence being 4 months however both can take longer. Expansion of existing facilities is the most efficient route in terms of cost and time; new sites will take a greater amount of time and will be subject to an Environmental Impact Assessment (EIA) in order to secure planning permission.

The environmental licence is charged annually, calculated according to 3 elements; activity and environmental components, and a compliance factor. The annual charge can in some cases be >15,000 GBP. Standing rent is levied by the Crown Estate on the basis of production levels: GBP 27.50 per tonne harvested for Mainland sites; GBP 24.75 per tonne for Western Isles sites; GBP 1,000 annual charge if a site is not in production for 4 consecutive years followed by a GBP 2,000 annual charge if the site is dormant for a further 2 years. A 100% increase to the dormancy charge then applies every second year a site remains inactive to encourage the use of dormant sites. Planning permission applications are also charged at GBP 183 per 0.1 hectare of farm surface area and GBP 63 per 0.1 hectare of sea bed while the SEPA licence application fee is GBP 4,202 for a new site.

Barriers to Entry – Licences

11.3 Regulation of fish farming in Ireland

Aquaculture in Ireland is licenced by The Minister for Agriculture, Food and the Marine, (MAFM) under the Fisheries (Amendment) Act, 1997 and its associated Regulations which have been amended to give effect to various EU environment protection Directives. The licensing process is complex.

The Aquaculture and Foreshore Management Division, (AFMD) of the Department manages the processing of aquaculture licences on behalf of the Minister. The Marine Engineering Division (MED) of the Department undertakes site mapping and provides certain technical advice on applications as well as undertaking certain post-licensing inspection duties. The Marine Institute (MI) provides scientific advice on a range of marine environment and aquaculture matters and in the case of applications which require Appropriate Assessment (AA) under EU Birds and Habitats Directives. Advice is also provided by Bord Iascaigh Mhara (BIM) and the Sea Fisheries Protection Authority (SFPA). The National Parks and Wildlife Services (NPWS) are consulted in relation to habitat protection. Inland Fisheries Ireland (IFI), An Taisce and the Commissioners of Irish Lights (CIL) are also consulted. Where relevant, the Local Authority and/or Harbour Authority are consulted. Land based fin fish units also require planning consent from the local authority. All applications are released for public consultation and comment.

An Environmental Impact Assessment (EIA) is mandatory for marine finfish applications and applicants are required to submit an EIS with their initial applications. The obligation to carry out an Appropriate Assessment (AA) applies if the application is within a Natura 2000 site or likely to impact on a Natura 2000 site. Decisions of the Minister in respect of aquaculture licence applications, including licence conditions, may be appealed to the Aquaculture Licences Appeals Board (ALAB). ALAB can confirm, refuse or vary a decision made by the Minister or issue licences itself under its own authority.

Licences are typically issued for 10 years. The 1997 Act provides for licence duration of up to 20 years. Foreshore (seabed) leases and licences are companion consents to Aquaculture Licences. Foreshore Acts allow for leases and licences to be granted for terms not exceeding ninety-nine years, respectively. Terms of current licences vary between harvest output (tons) per annum, smolt number input, maximum number of fish on site or a combination of these. Prior to expiry of a licence, an application for renewal of the licence must be made.

Currently the processing of a marine fin fish licence takes between 87 and 216 weeks. Most licences will be appealed to ALAB which can take at least a further 168 weeks to determine. The process of renewing expired fin fish licences takes as long as a new application.

In 2017, the Minister for Agriculture, Food and Marine initiated an independent review of the Aquaculture licencing system in Ireland. The report of this review was published in May 2017 with the overarching conclusion, that a root-and-branch reform of the aquaculture licence application processes is necessary which encompasses a further 30 recommendations.

Annual fin fish culture licence fees for a marine based fin fish site are €6.35 per tonne for the first 100 tonnes plus €6.35 for each additional tonne. Foreshore rental fees are charged at €63.49 for up to and including 5 hectares of foreshore with each additional hectare up to 10 ha at €31.74 and each additional hectare >10 and up to 20 at €63.49. Annual culture licence fee for a land-based site is €127.97 per annum.

Barriers to Entry – Licences

11.4 Regulation of fish farming in Chile

Licence and location
In Chile licensing is based on two authorisations. The first authorisation is required to operate an aquaculture facility and specifies certain technical requirements. It is issued by the Undersecretaries of Fisheries and Aquaculture (under the Ministry of Economy). The second authorisation relates to the physical area which may be operated (or permission to use national sea areas for aquaculture production). This is issued by the Undersecretaries of Fisheries for Armed Forces (Ministry of Defence). The use of the licence is restricted to a specific geographic area, to defined species, and to a specified limit of production or stocking density. The production and stocking density limits are specified in Environmental and Sanitary Resolutions for the issued licence. Under certain conditions, owners can chose to reduce their whole stocking, producing at maximum density (17kg/m3 for Atlantic salmon), or to maintain or increase their stocking, using a limited density (form 4 to 17 kg/m3 for Atlantic salmon) determinate by productive, sanitary and environmental conditions of each neighbourhood, any increase over previous stocking numbers means going to 4 kg/m3. Owners can choose only one alternative to stock each semester.

Access to Licences
The trading of licences in Chile is regulated by the General Law of Fisheries and Aquaculture (LGPA) and controlled by the Undersecretaries of Fisheries and Aquaculture of the Ministry of Economy. Aquaculture activities are subject to different governmental authorisations depending on whether they are developed in private fresh water inland facilities (i.e. hatcheries) or in facilities built on public assets such as lakes or rivers (freshwater licences) or at sea (seawater licences).

To operate a private freshwater aquaculture facility requires ownership of the water-use rights and holding of environmental permits. Environmental permits are issued when operators demonstrate that their facilities comply with the applicable environmental regulations.

Licences for aquaculture activities in public assets are granted based on an application, which must contain a description of the proposed operations, including a plan for complying with environmental and other applicable regulations. Licences granted after April 2010 are granted for 25 years and are renewable for additional 25-year terms. Licences granted before April 2010 were granted for indefinite periods. Licence holders must begin operation within one year of receiving a licence and once the operation has started, the licence holder cannot stop or suspend production for a period exceeding two consecutive years. Subject to certain exceptions, licence holders must maintain minimum operational levels of not less than 5% of the yearly production specified in the RCA (Environmental Qualification Resolution). Until August 2016, all licences not used could be kept by the holder if they prepared an official Sanitary Management Plan.

Licence holders must pay annual licence fees to the Chilean government and may sell or rent their licences. For the moment, no new licences will be granted in the most concentrated regions, Regions X, XI, and XII (Chile is made up of 16 administrative regions).

Barriers to Entry – Licences

11.5 Regulation of fish farming in Canada

Licence and location
Fish farming companies in Canada are subject to different regulations depending on the geographical area they operate in. The Federal Fisheries Act, Navigation Protection Act, Health of Animals Act and the National Aquaculture Activities Regulation (AAR) are some of them. The three geographical areas with fish farming are British Columbia, Newfoundland, and New Brunswick.

To operate a marine fish farm site, provincial and/or federal authorisations are required. In Newfoundland and New Brunswick, the Provincial government is the primary regulator and leasing authority. The Province regulates the activity and operations of aquaculture and issues the Aquaculture Licence and Crown Land lease where fish farms are located. In British Columbia both Federal and Provincial authorisations are required. The Federal Government regulates the activity and operations of aquaculture while the Provincial Government administers the Crown lands where fish farms are located. Individual site tenures have a specific timeline, varying between the different geographical areas and the provincial policy. In British Columbia, the timeline typically ranges from five to twenty years. In Newfoundland, the Crown Land Lease for the site is issued for 50 years and the aquaculture Licence is issued for 6 years. In New Brunswick, individual sites are typically granted for 20 years. All Commercial Aquaculture Licences are renewable but may be lost or suspended for non-compliance issues and non-payment of fees.

The production limitations in Canada are regulated as either a "Maximum Allowable Biomass" or a fixed number of smolt per cycle. "MAB" is specific to each Aquaculture licenced facility in British Columbia. Smaller farms are typically licenced for 2,200mt. with larger capacity facilities licenced to produce 5,000 mt. per cycle. In Newfoundland and New Brunswick, a maximum number of smolt per cycle is given to a farm. Farms are typically licenced for 600,000 to 1,000,000 smolt per cycle in Newfoundland, and 270,000 to 350,000 smolt per cycle in New Brunswick.

Barriers to Entry – Licences

Access to Licences

In British Columbia, all permits and licences require consultation with First Nations and local stakeholders. The time taken to acquire licences for a new farm can vary from one to several years. Recently the Provincial government instituted a moratorium on new site applications. However, they have allowed existing sites to amend their tenure size and infrastructure if specific conditions apply. Companies can still obtain new tenures by relocating existing tenures to locations "more suitable for safety or matters of public interest."

In Newfoundland, proponents must submit a sea cage licence application to the Newfoundland Department of Fisheries and Land Resources for each new or acquired marine site. In New Brunswick, companies must submit an Aquaculture licence Application for Marine Sites to the Department of Agriculture, Aquaculture and Fisheries (New Brunswick). It takes about nine months to transition an existing site to a new owner, and approximately one year for a new application in both places. This includes obtaining all necessary approvals and licences, and a review from The Department of Fisheries and Oceans (Federal). Consultation with residents, towns, development groups and commercial/recreational fishermen is required. In Newfoundland, all new sites of the same company must be 1 km apart, 5 km if sites are operated by different companies.

In Newfoundland, Provincial approvals can be assigned to a different operator through a government sub-lease assignment process, however, licences are not transferable. A company may transfer licences to another company providing the rationales for the assignment are supported by the government processes in New Brunswick.

11.6 Regulation of fish farming in the Faroe Islands

Licence and location

Fish farming companies in the Faroe Islands are subject to extensive regulation. The most important legislative instruments are the Aquaculture Act (Act No. 83 from 25 May 2009 with latest amendments from 2018), the Environmental Act (Act No. 134 from 29 October 1988 with latest amendments from 2008) and the Food Safety Act (Act No. 58 from 26 May 2010 with latest amendments from 2017).

In addition to the above-mentioned acts, several Executive Orders with more detailed provisions covering fish farming have been issued under the provisions of the acts.

The right according to a specific licence is provided for a specific geographic area and with a limit of production specified in the individual licence. Production and stocking density limit is specified in an Environmental and Sanitary Resolution issued for each specific licence. The density limit may depend on production conditions as well as sanitary and environmental conditions.

The size of the area and density limits etc. for each of the 22 sea licences vary greatly. Production limitations in the Faroes are not regulated through limits on "maximum allowed biomass", MAB. As a consequence, MAB for salmon farms varies between 1,200 tonnes and 5,800 tonnes a year per licence, depending on site characteristics and the geographic location of the individual farm.

In 2012 and 2018 the Government of the Faroe Islands announced revised aquaculture regulations with the aim of securing sustainable growth in the industry and in order to implement anti-trust regulations.

Mowi Faroes is first and foremost affected by the anti-trust regulations in the Aquaculture Act. These rules set a cap of 20% for either direct or indirect foreign ownership in Faroese fish farming companies. If the limit is exceeded with regard to a fish farming company, the company must adjust its ownership to be within the limit within a short deadline set by the authorities or face possible loss of the right to conduct fish farming activities.

Mowi Faroes is 100% owned by Mowi ASA (NO). This ownership is protected by transitional provisions in the Aquaculture Act, securing that the company can remain owned by a foreign company and nonetheless keep its licences. The consequence for Mowi Faroes of the Anti-trust regulations is that the company cannot expand its business with additional commercial licences to farm fish in the sea. Mowi Faroes can however apply for development licences and licences on land.

It is stipulated in the Aquaculture Act that a fish farming company cannot hold more than 50% of the total sea licences. The new restrictions do not apply to licences held by each individual company today, but the new regulations specify that Mowi Faroes can keep its 3 seawater licences and 1 smolt licence, even though the company does not comply with the new cap on foreign-held capital.

Barriers to Entry – Licences

Access to Licences

In order to conduct fish farming activities in the Faroe Islands, the fish farming company must obtain authorisation from Heilsufrøðiliga Starvsstovan (The Faroese Food and Veterinary Authority) to operate an aquaculture facility. The authorisation specifies certain technical requirements with regard to conducting fish farming activities.

Fish farming companies with the above mentioned authorisation can apply for licences to conduct fish farming activities from the Ministry of Foreign Affairs and Trade. New sea licences can be awarded by the Ministry of Foreign Affairs and Trade. There is today a limit of 22 commercial seawater licences and no limit for licences on land. If new licences are to be awarded, they may be awarded through auction.

An application for a seawater licence must contain a description of the proposed operations, including a plan for complying with environmental and other applicable regulations.

The government of the Faroe Islands in April 2018 announced a new category of licences, i.e. development licences. Development licences are intended to motivate investment in new fish farming technologies. Due to the anti-trust regulations, Mowi Faroes can only obtain development licences, as the limits regarding foreign ownership do not apply to such licences.

Licences are granted for 12 years and are renewable for additional 12-year term. Licence holders must pay an annual fee of DKK 12,000 for each individual licence. Fish farming companies must also pay a harvesting fee based on the harvesting of farmed fish. The fee is based on the weight of gutted fish harvested in a month, multiplied by the average international market price in the same month.

Licences can be sold and pledged, and legal security is perfected by registration with the Land Registry. Licences may be withdrawn in cases of material breach of conditions set out in the individual licence or in the aquaculture or environmental legislation.

12 Risk Factors

Risk Factors

12.1 Salmon disease prevention and treatment

Maximising survival and maintaining healthy fish stocks are primarily achieved through good husbandry and health management practices and policies, which reduce exposure to pathogens and the risk of health challenges. The success of good health management practices has been demonstrated on many occasions and has contributed to an overall improvement in the survival of farmed salmonids.

Fish health management plans, veterinary health plans, biosecurity plans, risk mitigation plans, contingency plans, disinfection procedures, surveillance schemes as well as coordinated and synchronised zone/area management approaches, all support healthy stocks with emphasis on disease prevention.

Prevention of many diseases is achieved through vaccination at an early stage and while the salmon are in freshwater. Vaccines are widely used commercially to reduce the risk of health challenges. With the introduction of vaccines a considerable number of bacterial and viral health issues have been effectively controlled, with the additional benefit that the quantity of medicine prescribed in the industry has been reduced.

In some instances medicinal treatment is still required to maximize survival rates and for the well-being and welfare of the fish. Even the best managed farms may have to use medicines from time to time. For several viral diseases, no effective vaccines are currently available.

12.2 Most important health risks to salmon

Sea lice: There are several species of sea lice, which are naturally occurring seawater parasites. They can infect the salmon skin and if not controlled they can cause lesions and secondary infection. Sea lice are controlled through good husbandry and management practices, the use of lice prevention barriers (e.g. skirts), cleaner fish (different wrasse species and lumpsuckers, which eat the lice off the salmon), mechanical removal systems and when necessary licenced medicines.

Cardiomyopathy syndrome (CMS): CMS is a chronic disease that can develop over several months and is caused by the piscine myocarditis virus (PMCV). Mortality typically occurs in large seawater fish. A typical clinical outbreak can last one to six months. Control is achieved mainly by good husbandry and management practices and keep the fish in conditions that satisfy their biological needs for food, clean water, space and habitat.

Pancreas Disease (PD): PD is caused by the Salmonid Alphavirus and is present in Europe. It is a contagious virus that can cause reduced appetite, muscle and pancreas lesions, lethargy, and if not appropriately managed, elevated mortality. PD affects Atlantic salmon and rainbow trout in seawater and is controlled mainly by management and mitigation practices. Vaccination is also used in combination with these measures where PD represents a risk, providing some additional level of protection. In addition, selective breeding for PD-resistant fish has also contributed to reducing the incidence of PD.

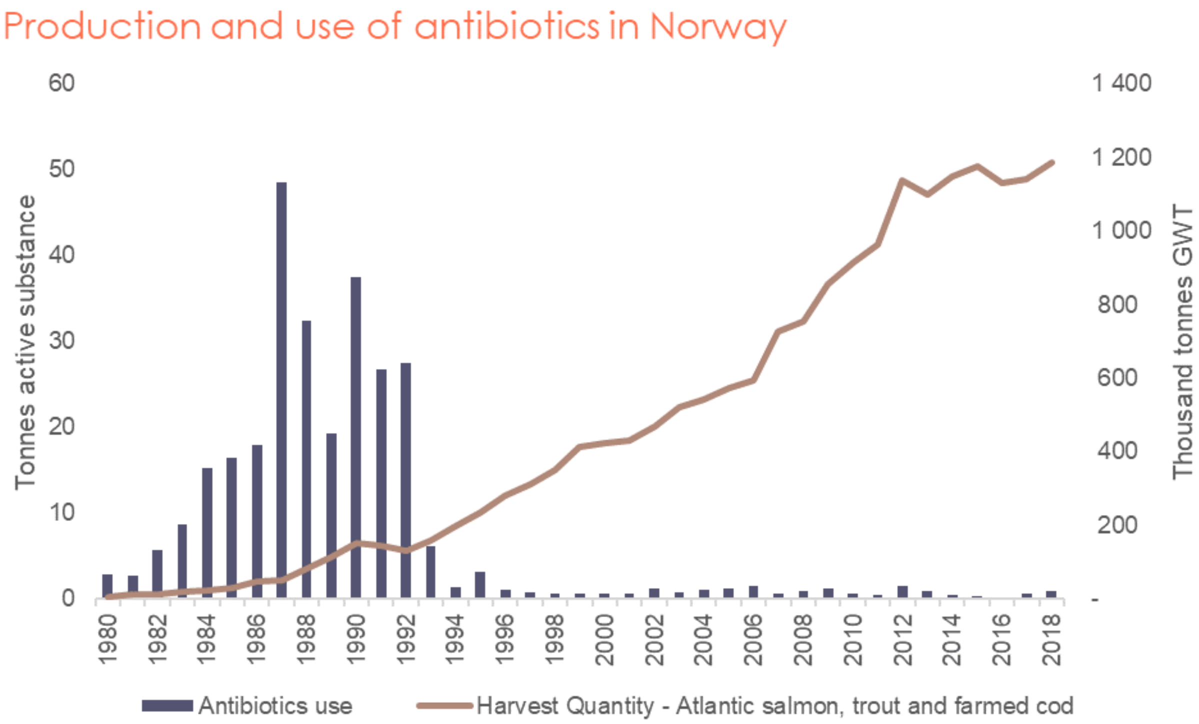
Salmonid Rickettsial Septicaemia (SRS): SRS is caused by intracellular bacteria. It occurs mainly in Chile but has also been observed, albeit to a much lesser extent, in Norway, Ireland, Canada and the UK. It causes lethargy and appetite loss, and can result in elevated mortality. SRS is to some extent controlled by vaccination, but medicinal intervention may also be required.

Heart and Skeletal Muscle Inflammation (HSMI): HSMI is currently reported in Norway and to a lesser extent Scotland. Symptoms of HSMI are reduced appetite, abnormal behaviour and in most cases low mortality. HSMI generally affects fish in their first year in seawater and control is achieved mainly by good husbandry and management practices.

Infectious Salmon Anaemia (ISA): ISA is caused by the ISA virus and is widely reported. It is a contagious disease that causes lethargy and anaemia and may lead to significant mortality in seawater if not appropriately managed. Control of an ISA outbreak is achieved through culling or harvesting of affected fish in addition to other biosecurity and mitigation measures. Vaccines are available and are in use in areas where ISA is considered to represent a risk.

Gill Disease (GD): GD is a general term used to describe gill conditions occurring in seawater. The changes may be caused by different infectious agents; amoeba, virus or bacteria, as well as environmental factors including algae or jellyfish blooms. Little is known about the cause of many of the gill conditions and to what extent infectious or environmental factors are primary or secondary causes of disease.

12.3 Fish health and vaccination (Norway)



The incidence of bacterial disease outbreaks increased in the 1980s. In the absence of effective vaccines, the use of antibiotics reached a maximum of almost 50 tonnes in 1987. Following the introduction of effective vaccines against the main health challenges of the time, the quantity of antibiotics used in the industry declined significantly to less than 1.4 tonnes by 1994 and has since then continued to be very low. These developments, along with the introduction of more strict biosecurity and health management strategies, allowed for further expansion of the industry and an increase in production.

During the last two decades there has been a general stabilisation of mortality in Norway, Scotland and Canada, which has been achieved principally through good husbandry, good management practices and vaccination. The trend in Chile in recent years stems from infection pressure from SRS in the industry.

Source: Kontali Analyse, Norsk medisinaldepot, Norwegian Institute of Public Health

12.4 Research and development focus

Fish Welfare and Robustness

- Development of better solutions for prevention and control of infectious diseases
- Minimization of production-related disorders
- Optimisation of smolt quality

Product Quality and Safety

- Continuously develop better technological solutions for optimised processing, packaging and storage of products, while maintaining consistently high quality.

New Growth

- Development of methods to reduce production time at sea
- Production in exposed areas
- Production in closed sea-going units

Production Efficiency

- Development of cost effective, sustainable and healthy salmon diets which ensure production of robust fish
- Identify the best harvesting methods, fillet yield optimisation and the most efficient transport and packaging solutions
- Net solutions and antifouling strategies
- Development of AI-based tools for value chain optimization and boosting seawater-phase production efficiency

Footprint

- Develop, validate and implement novel methods for sea lice control
- Reduce dependency on medicines and limit the discharge of medicinal residues
- Escape management and control
- ASC implementation; R&D projects that will facilitate and make ASC implementation more efficient

According to Zacco (Norwegian patenting office), the rate of patenting in the salmon farming industry has grown rapidly in the last two decades. Considerable R&D is undertaken in several areas and the most important developments have been seen in the feed, sea lice control and vaccine sectors, carried out by large global players. In this industry most producers are small and do not have the capital to undertake and supervise major R&D activities. This is expected to change as consolidation of the industry continues.

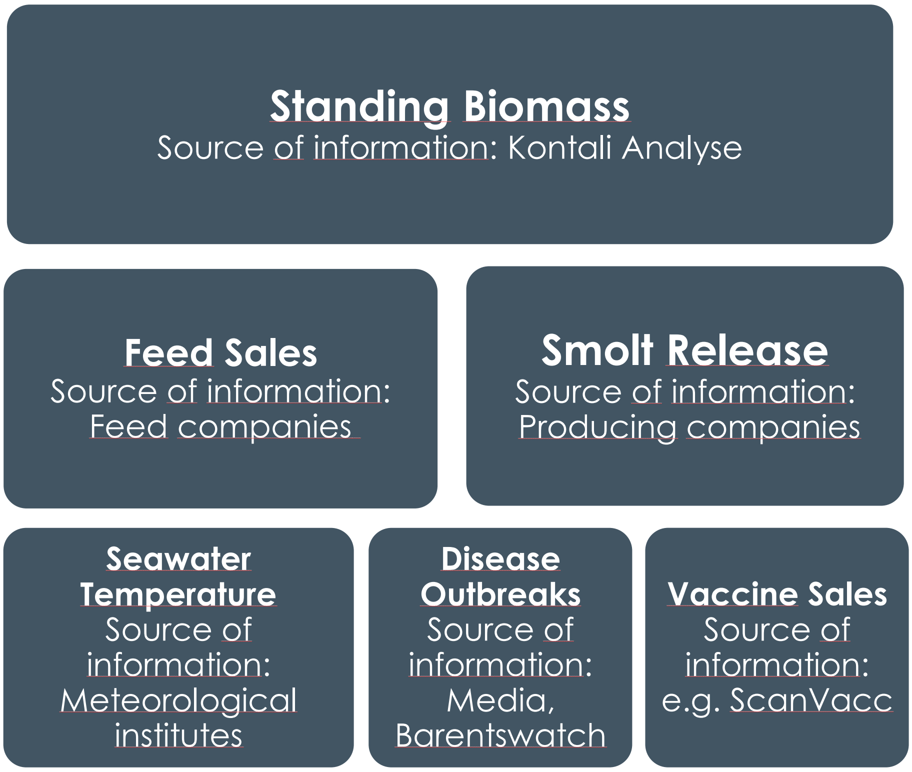
Smolt, on-growing production and processing

The technology used in these phases can be bought "off the shelf" and very few patents are granted. Technology and producers are becoming increasingly more advanced and skilled.

13 Indicators Determining Harvest volumes

Indicators Determining Harvest volumes

13.1 Projecting future harvest volumes



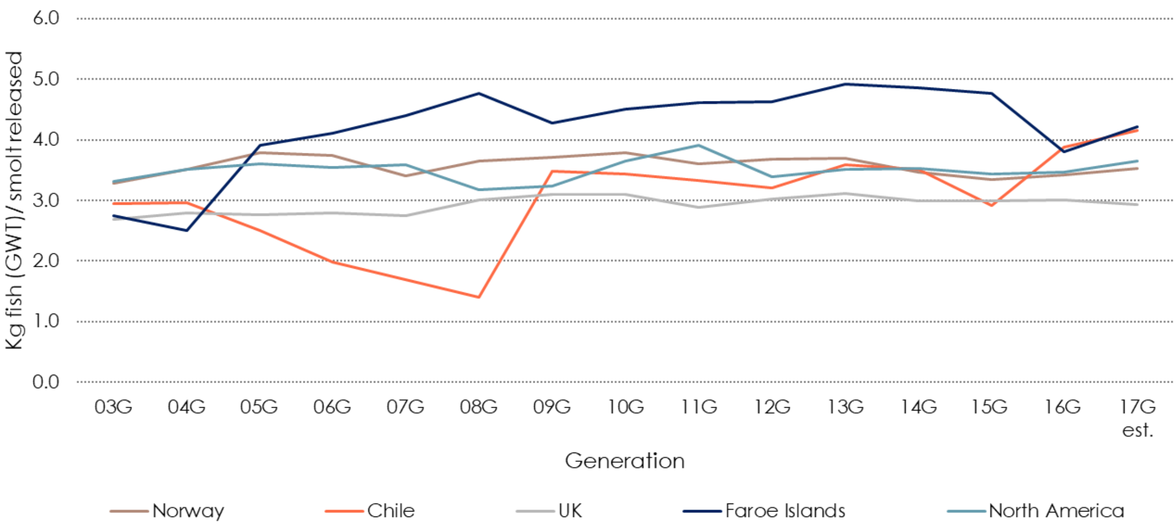
The three most important indicators for future harvest volumes are standing biomass, feed sales and smolt release. These are good indicators for medium- and long-term harvest, while the best short-term indicator is standing biomass categorized by size. As harvested size is normally above 4 kg, the available biomass this size class is therefore the best estimate of short-term supply.

If no actual numbers on smolt releases are available, vaccine sales could be a good indicator of number of smolt releases and when the smolt is put to sea. This is a good indicator of long-term harvest volumes as it takes up to 2 years smolt release to harvest.

Variation in seawater temperature can materially impact the length of the production cycle. A warmer winter can for example increase harvest volumes for the relevant year, partly at the expense of the subsequent year.

Disease outbreaks can also impact harvest volume due to mortality and growth slowdown.

13.2 Yield per smolt



Yield per smolt is an important indicator of production efficiency. Due to the falling cost curve and the discounted price of small fish, the economic optimal harvest weight is in the area of 4-5 kg (GWT). The number of harvested kilograms yielded from each smolt is impacted by diseases, mortality, temperatures, growth attributes and commercial decisions.

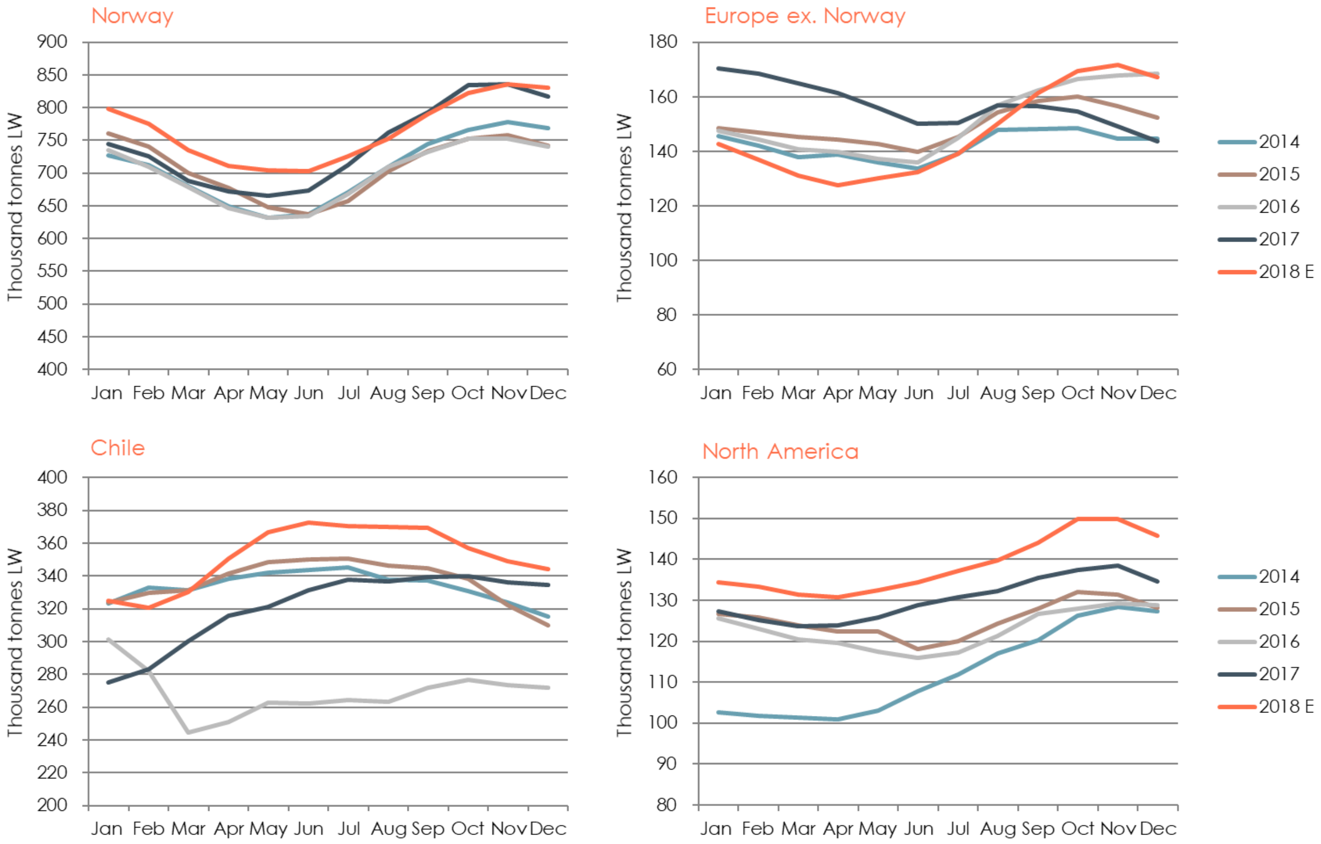
The average yield per smolt in Norway is estimated at 3.52 kg (GWT) for the 17 Generation.

Since 2010, the Chilean salmon industry has been rebuilding its biomass after the depletion caused by the ISA crisis which began in 2007. In 2010/11, the Chilean salmon industry performed well on fish harvested, due to the low density of production (improved yield per smolt). In line with increased density in subsequent years, biological indicators deteriorated. In 2016, an algae bloom caused high mortality, and the Chilean salmon industry started to rebuild its biomass once again. Recently, the yield per smolt has improved in Chile, and the average for 17G is estimated at 4.16 kg (GWT).

Average yield in the UK, North America and Faroe Islands for 17G is estimated at 2.92kg, 3.65kg and 4.21kg, respectively.

Source: Kontali Analyse, Mowi

13.3 Development in biomass during the year



Due to variations in seawater temperature during the year, the total standing biomass in Europe has a S-curve, which is at its lowest in May and at its peak in October. The Norwegian industry is focused on minimising natural fluctuations as licence constraints put a limit to how much biomass can be in sea at the peak of the year.

In Chile the situation is different due to more stable seawater temperatures and opposite seasons (being in the Southern hemisphere). A more consistent water temperature allows for smolt release throughout the year and enables more uniform utilisation of facilities. The relatively low standing biomass in Chile from March 2016 is due to the impact of an algae bloom.

Source: Kontali Analyse

14 Secondary Processing (VAP)

Secondary Processing (VAP)

In processing we distinguish between primary and secondary processing.

Primary processing is slaughtering and gutting. This is the point in the value chain at which standard price indexes for farmed salmon are set.

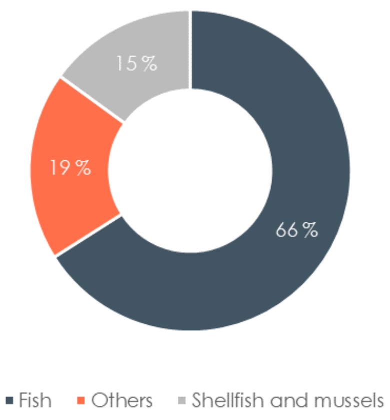
Secondary processing is filleting, fillet trimming, portioning, producing different cuts like cutlets, smoking, making ready meals or Packing with Modified Atmosphere (MAP).

Products that have been secondary processed are called value-added products (VAP).

Secondary Processing (VAP)

14.1 European value-added processing (VAP) industry

- A total value of > EUR 25 billion
- Employees > 135,000
- Extremely fragmented – more than 4,000 companies
- About 50% of all companies have fewer than 20 employees
- Traditionally EBIT-margins have been between 2% and 5%
- The average company employs 33 people and has a turnover of EUR 4.2 million



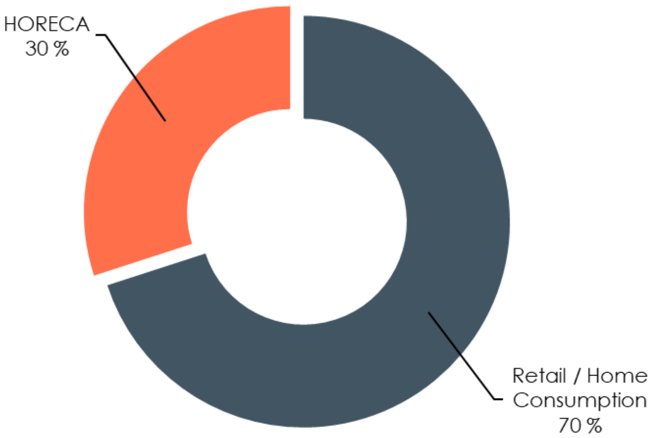
The seafood industry in Europe is fragmented with more than 4,000 players. Most of the companies are fairly small, but there are also several companies of significant size involved in the secondary processing industry: Mowi, Icelandic Group, Deutsche See, Caladero, Royal Greenland, Labeyrie, and Lerøy Seafood.

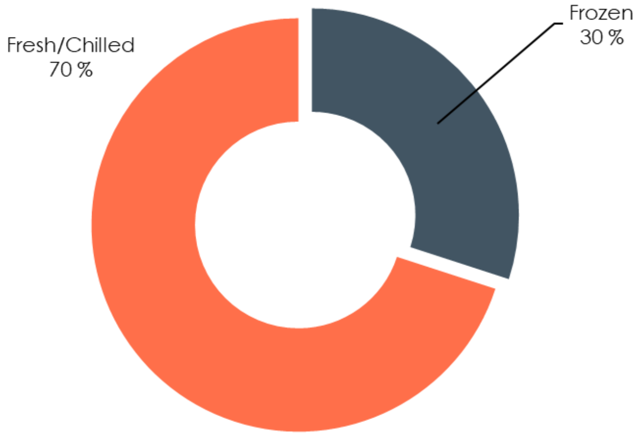
Most of the largest players base their processing on Atlantic salmon, producing smoked salmon, salmon portions or ready meals with different packing techniques such as vacuum or modified atmosphere (MAP).

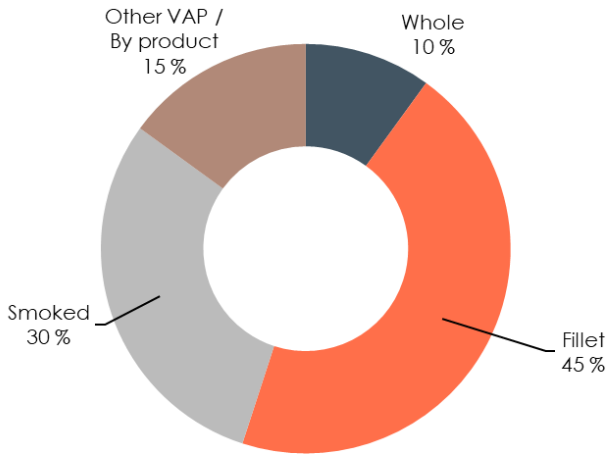
Consumers are willing to pay for quality and value added. This means that we expect to see an increase in demand for convenience products such as ready-to-cook fish, together with a packing trend towards MAP as this maintains the freshness of the product longer for than fish sold in bulk.

Secondary Processing (VAP)

14.2 Market segment in the EU (2018)







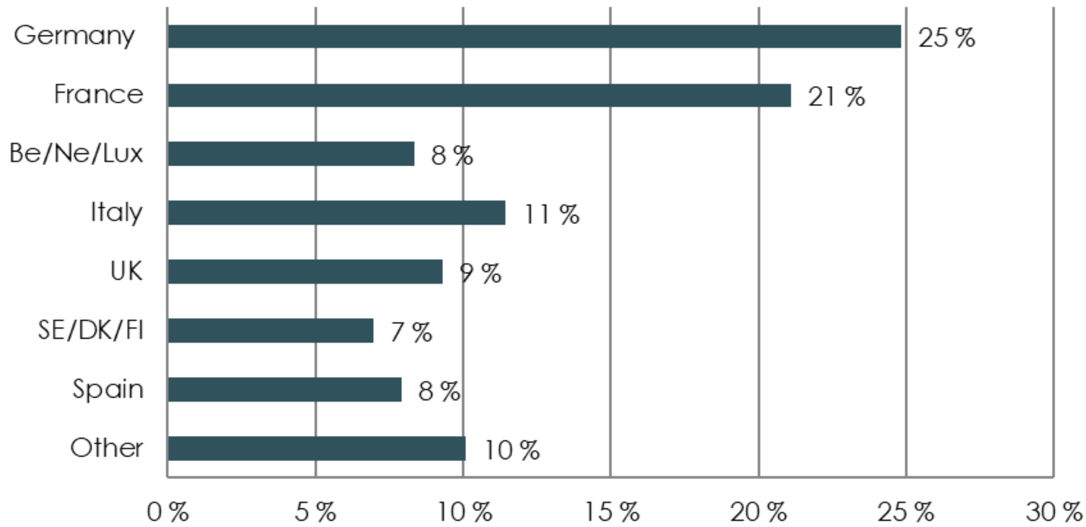
In the EU, around 70% of Atlantic salmon supply went to retailers while the remainder was sold to food service establishments. Approximately 70% was sold fresh. Of the different products, fillets had the largest market share of 45% followed by smoked. “Other VAP” consists of all value-added processed products, except smoked salmon.

Source: Kontali Analyse
Note: Horeca = Hotel, restaurants and café (or establishments which prepare and serve food and beverages)

Secondary Processing (VAP)

14.3 The European market for smoked salmon

Est. % share of smoked salmon market - EU 2018E



Smoked salmon is the most common secondary-processed product based on Atlantic salmon. The European market for smoked salmon was estimated to be 263,000 tonnes GWT in 2018, with Germany and France the largest markets. Assuming 50% yield from gutted weight to product weight, the European market consumed 131,500 tonnes product weight of smoked salmon in 2018.

European smoked salmon producers (2018E)
The ten largest producers of smoked salmon in Europe are estimated to have a joint market share of more than 60%. The production is mainly carried out in Poland, France, the UK, the Baltic states and the Netherlands.

Mowi produces its smoked salmon in Poland (Ustka), UK (Rosyth), France (Kritsen) Belgium (Oostende) and Turkey (Istanbul), and its main markets are Germany, France, Italy and Belgium. After the acquisition of Morpol in 2013, Mowi became the largest producer of smoked salmon. Labeyrie is the second largest and sells most of its products to France, and has also significant sales to the UK, Spain, Italy and Belgium.

Estimated Annual Raw Material - Tonnes HOG			
70 - 90 000	20 - 40 000	10 - 20 000	5 - 10 000
Mowi Consumer Products (PL-FR-UK)	Labeyrie (FR-UK) Lerøy (NL-SE-NO)	Norvelita (LT) Mer Alliance (FR) Suempol (PL) Delpeyrat (FR) Young's Seafood (UK)	Martiko (ES) Friedrichs (DE) Milarex (PL) Intermarché (FR) Foppen (NL) Ubago (ES)

Source: Kontali Analyse

Appendix

Appendix

	Atlantic salmon
Live fish	100%
Loss of blood/starving	7%
Harvest weight / Round bled fish (wfe)	93%
Offal	9%
Gutted fish, approx. (HOG)	84%
Head, approx.	7%
Head off, gutted	77%
Fillet (skin on)	56 - 64%
C-trim (skin on)	60%
Fillet (skin off)	47 - 56%

Net weight
Weight of a product at any stage (GWT, fillet, portions). Only the weight of the fish part of the product (excl. ice or packaging), but including other ingredients in VAP

Primary processing
Gutted Weight Equivalent (GWT) / Head on Gutted (HOG)

Secondary processing
Any value added processing beyond GWT

Biomass
The total weight of live fish, where number of fish is multiplied by an average weight

Ensilage
Salmon waste from processing with added acid

BFCR
IB feed stock + feed purchase – UB feed stock
Kg produced – weight on smolt release

EFCR
IB feed stock + feed purchase – UB feed stock
Kg produced – mortality in Kg – weight on smolt release

Price Notifications
Nasdaq **(**FCA Oslo) - Head on gutted from Norway (weighted average superior quality)
FOB Miami - fillets from Chile (3-4 lb)
FOB Seattle - whole fish from Canada (10-12 lb)

Source: Kontali Analyse

Appendix

Price indices vs. FOB packing plant

Norwegian NASDAQ-Index - Selling price for superior gutted, fresh salmon iced and packed in boxes - FCA Oslo

NASDAQ Index	
- General sales and administration expences	~ 0.75 NOK
= Former NOS/FHL-index	
- Freight to Oslo - Terminal Cost	~ 0.70 NOK
= Selling price farmers FOB packing plant	

Norwegian SSB custom statistics - all sizes, all qualities and included contract sales

SSB	
- Freight to border - Duty and taxes - Adjusted to sizes and quality - Freight to Oslo - Terminal cost	~ 1.50 NOK*
= Selling price farmers FOB packing plant	

Urner Barry FOB Miami - Chilean atlantic salmon fillets, PBO, d-trim delivered FOB Miami

UB
- See text below

= Selling price farmers FOB packing plant

Urner Barry FOB Seattle - West Coast atlantic salmon - whole - fresh delivered FOB Seattle

FOB Seattle
- Freight (~6 cent/lb)

= Selling price farmers FOB packing plant

Several price indices for salmon are publicly available. The two most important providers of such statistics for Norwegian salmon are Nasdaq/Fish Pool and Statistics Norway (SSB). Urner Barry in the US provides a reference price for Chilean salmon in Miami and Canadian salmon in Seattle.

In Norway the price is found by deducting freight costs from the farm to Oslo and the terminal cost from the Nasdaq price (~0.70 NOK). If using the SSB custom statistics, you need to adjust for freight to border, duty and taxes, and for quality and contract sales to get the achieved spot price back to producer. The average difference between SSB price and FCA Oslo is ~1 NOK, which gives the average difference between SSB price and back to plant at NOK 1.50 (historically this difference fluctuates from week to week and will normally fall in the range of -2 to +4).

Calculating Urner Barry – Chilean fillets, back to GWT plant is more extensive. It is necessary to use UB prices for both 2/3lb and 3/4lb and adjust for quantity share, market handling (4 cent), and market commission (4.5%). In addition there are some adjustments which vary over time; premium fish share (~92%), reduced price on downgraded fish (~30%), airfreight (~USD 1.50/kg) and GWT to fillet yield (~70%).

* Average difference between SSB and return to packing plant
Source: Fishpool, Nasdaq, SSB, Norwegian Seafood Council, Urner Barry, Kontali Analyse

Historic acquisitions and divestments

In Norway there have been 'countless' mergers between companies over the last decade. The list below shows only some of the larger ones in transaction value. In Scotland consolidation has also been very frequent. In Chile, there have been several acquisitions over the last two years. Canada's industry has been extensively consolidated with a few large players and some small companies.

See table on the next page.

Appendix

Year	Norway
1999	Hydro Seafoods - Sold from Norsk Hydro to Nutreco Aquaculture
2001	Gjølaks - Sold to PanFish
2001	Vest Laks - Sold to Austevoll Havfiske
2001	Torris Products - Sold from Torris to Seafarm Invest
2001	Gjølanger Havbruk - Sold to Aqua Farms
2001	Alf Lone - Sold to Sjøtroll
2001	Sandvoll Havbruk - Sold to Nutreco Aquaculture
2001	Fosen Edelfisk - Sold to Salmar
2001	Langsteinfisk - Sold to Salmar
2001	Tveit Gård - Sold to Alsaker Fjordbruk
2001	Petter Laks - Sold to Senja Sjøfarm
2001	Kråkøyfisk - Sold to Salmar
2002	Amulaks - Sold to Follalaks
2002	Kvamsdal Fiskeoppdrett - Sold to Rong Laks
2002	Matland Fisk - Sold to Bolaks
2002	Sanden Fiskeoppdrett - Sold to Aqua Farms
2002	Ørsnes Fiskeoppdrett - Sold to Aqua Farms
2002	Toftøysund Laks - Sold to Alsaker Fjordbruk
2003	Nye Midnor - Sold from Sparebank1 MidtNorge to Lerøy Seafood Group
2003	Ishavslaks - Sold to Aurora to Volden Group
2003	Loden Laks - Sold to Grieg Seafood
2003	Finnmark Seafood - Sold to Follalaks
2003	Ullsfjord Fisk - Sold to Nordlaks
2003	Henningsværfisk - Sold to Nordlaks
2004	Flatanger Akva - Sold to Salmar
2004	Naustdal Fiskefarm/Bremanger Fiskefarm - Sold to Firda Sjøfarm
2004	Fjordfisk - Sold to Firda Sjøfarm
2004	Snekvik Salmon - Sold to Lerøy Seafood Group
2004	Aure Havbruk / M. Ulfsnes - Sold from Sjøfor to Salmar
2005	Follalaks - Sold to Cermaq
2005	Aqua Farms - Sold to PanFish
2005	Aurora Salmon (Part of company) - Sold from DNB Nor to Lerøy Seafood Group
2005	Marine Harvest Bolga - Sold to Seafarm Invest
2005	Aurora Salmon (Part of company) - Sold from DNB Nor to Polarlaks
2005	Sjølaks - Sold from Marine Farms to Northern Lights Salmon
2005	Bolstad Fjordbruk - Sold to Haugland Group
2005	Skjervøyfisk - Sold to Nordlaks
2006	Fossen AS - Sold to Lerøy Seafood Group
2006	Marine Harvest N.V. - Acquired by Pan Fish ASA
2006	Fjord Seafood ASA. - Acquired by Pan Fish ASA
2006	Marine Harvest Finnmark - Sold from Marine Harvest to Volden Group
2006	Troika Seafarms/North Salmon - Sold to Villa Gruppen
2006	Aakvik - Sold to Hydrotech
2006	Hydrotech - Sold to Lerøy Seafood Group
2006	Senja Sjøfarm - Sold to Salmar ASA
2006	Halsa Fiskeoppdrett - Sold to Salmar ASA
2006	Langfjordlaks - Sold to Mainstream
2006	Polarlaks - Sold to Mainstream
2007	Veststar - Sold to Lerøy Seafood Group
2007	Volden Group - Sold to Grieg Seafood
2007	Artic Seafood Troms - Sold to Salmar ASA
2007	Arctic Seafood - Sold to Mainstream
2007	Fiskekultur - Sold to Haugland Group

Year	Norway
2007	UFO Laks - Sold to Haugland Group
2007	Anton Misund - Sold to Rauma Gruppen
2007	Mico Fiskeoppdrett - Sold to Rauma Gruppen
2008	Hamneidet - Sold to Eidsfjord Sjøfarm
2008	Misundfisk - Sold to Lerøy Seafood Group
2008	Henden Fiskeoppdrett - Sold to Salmar ASA
2008	AS Tri - Sold to Norway Royal Salmon (NRS)
2008	Feøy Fiskeopprett - Sold to Norway Royal Salmon
2008	Salmo Arctica - Sold to Norway Royal Salmon
2008	Åmøy Fiskeoppdrett - Sold to Norway Royal Salmon
2008	Nor Seafood - Sold to Norway Royal Salmon
2008	Altafjord Laks - Sold to Norway Royal Salmon
2008	Lerøy Seafood Group - Purchased by Austevoll Seafood
2009	Skjærgårdsfisk - Sold to Lingalaks
2009	Brilliant Fiskeoppdrett - Sold to Norway Royal Salmon
2009	Polarlaks II - Sold to Nova Sea
2009	Fjordfarm - Sold to Blom Fiskeoppdrett
2009	Fyllingsnes Fisk - Sold to Eide Fjordbruk
2009	Salaks merged with Rølaks
2009	65 new licenses granted
2010	Espevær Fiskeoppdrett - Sold to Bremnes Fryseri
2010	AL Nordsjø - Sold to Alsaker Fjordbruk
2010	Nord Senja Fiskeindustri - Sold to Norway Royal Salmon
2010	Marøy Salmon - Sold to Blom Fiskeoppdrett
2010	Fjord Drift - Sold to Tombre Fiskeanlegg
2010	Hennco Laks - Sold to Haugland Group
2010	Raumagruppen - Sold to Salmar
2010	Stettefisk / Marius Eikremsvik - Sold to Salmar
2010	Lund Fiskeoppdrett - Sold to Vikna Sjøfarm (Salmonor)
2010	Sjøtroll Havbruk AS - 50.71% of the shares sold to Lerøy Seafood Group
2011	R. Lernes - Sold to Måsøval Fiskeoppdrett
2011	Erfjord Stamfisk - Sold to Grieg Seafood
2011	Jøkelfjord Laks - Sold to Morpol
2011	Krifo Havbruk - Sold to Salmar
2011	Straume Fiskeoppdrett - Sold to Marine Harvest Norway
2011	Bringsvor Laks - Sold to Salmar
2011	Nordfjord Havbruk - Changed name to Nordfjord Laks
2011	Villa Miljølaks - Sold to Salmar
2011	Karma Havbruk - Sold to E. Karstensen Fiskeoppdrett (50%) and Marø Havbruk (50 %)
2012	Skottneslaks - Sold to Eidsfjord Laks
2012	Villa Arctic - 10 licenses, etc. sold to Salmar
2012	Pundslett Laks - Sold to Nordlaks Holding
2012	Strømsnes Akvakultur – Sold to Blom Fiskeoppdrett
2012	Ilsvåg Matfisk – Sold to Bremnes Seashore
2013	Morpol – sold to Marine Harvest
2013	Villa Organic – 47.8% of shares sold to Lerøy Seafood Group
2013	Villa Organic – 50.4% of shares sold to SalMar
2013	Salmus Akva - Sold to Nova Sea
2014	Skarven (Sømna Fiskeoppdrett and Vik Fiskeoppdrett) - Sold to Nova Sea
2014	Cermaq – sold to Mitsubishi
2015	EWOS - 2 licenses, sold to Bolaks
2015	Senja Akvakultursenter - Sold to Lerøy Aurora
2016	Fjordlaks Aqua - Sold to Hofseth International and Yokohama Reito
2017	NTS acquired Midt Norsk Havbruk

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Appendix

Year	UK	Year	Chile	Year	North America
1996	Shetland Salmon products - Sold to HSF GSP	1999	Chisal - Sold to Salmones Multiexport	1989	Cale Bay Hatchery - Sold to Kelly Cove Salmon
1996	Straithaird Salmon to MH	2000	Salmo America - Sold to Fjord Seafood	1994	Anchor Seafarms Ltd., Saga Seafarms Ltd., 387106 British Columbia Ltd., and United hatcheries merged into Omega Salmon Group (PanFish)
1996	Gigha, Mainland, Tayinlaoan, Mull Salmon - All sold to Aquascot	2000	Salmones Tecmar - Sold to Fjord Seafood	1997	ScanAm / NorAm - Sold to Pan Fish
1997	Summer Isles Salmon - Sold to HSF GSP	2000	Salmones Mainstream - Sold to Cermaq	2001	Scandic - Sold to Grieg Seafoods
1997	Atlantic West - Sold to West Minch	2001	Pesquera Eicosal - Sold to Stolt Nielsen	2004	Stolt Sea Farm - merged with Marine Harvest
1998	Marine Harvest Scotland - Sold from BP Nutrition to Nutreco	2003	Marine Farms - Sold to Salmones Mainstream	2004	Atlantic salmon of Maine (Fjord Seafood)- Sold to Cooke Aquaculture
1998	Gaelic Seafood UK - Sold to Stolt Seafarms	2004	Salmones Andes - Sold to Salmones Mainstream	2004	Golden Sea Products (Pan Fish) - Sold to Smokey Foods
1998	Mainland Salmon - Sold to Aquascot	2004	Stolt Seafarm - Merged with Marine Harvest	2005	Heritage (East) - Sold to Cooke Aqua
1999	Hydro Seafood GSP - Initially sold to Nutreco as part of Hydro Seafood deal	2004	Pesquera Chillehue - Sold to GM Tornegaleones	2005	Heritage (West) - Sold to EWOS/Mainstream
199	Joseph Johnston & Sons - Sold to Loch Duart	2005	Aguas Claras - Sold to Acua Chile	2006	Marine Harvest - Sold to Pan Fish
2000	Aquascot Farming - Sold from Aquascot to Cermaq	2005	Salmones Chiloè - Sold to Aqua Chile	2007	Target Marine - Sold to Grieg Seafoods
2000	Shetland Norse - Sold to EWOS	2005	Robinson Crusoe - Sold to Aqua Chile	2007	Shur-Gain (feed plant in Truro)- Sold to Cooke Aquaculture
2000	Hydro Seafood GSP - Sold to Norskott Havbruk (Salmar & Lerøy Seafood Group) from Nutreco	2006	GM Tornegaleones - change name to Marine Farm GMT	2008	Smokey Foods - Sold to Icicle Seafoods
2001	Laschinger UK - Sold to Hjaltland	2006	Merger Pan Fish - Marine Harvest - Fjord Seafood	2011	Vernon Watkins' Salmon Farming (NFL - Canada East) - Sold to Cooke Aquaculture
2001	Wisco - Sold to Fjord Seafood	2007	Pacific Star - Sold to Andrè Navarro	2012	Ocean Legacy/Atlantic Sea Smolt (NS - Canada East) - Sold to Loch Duart
2002	Wester Sound / Hoganess - Sold to Lakeland Marine	2007	Salmones Cupquelan - Sold to Cooke Aqua	2014	Cermaq – sold to Mitsubishi
2004	Ardvar Salmon - Sold to Loch Duart	2009	Patagonia Salmon Farm - Sold to Marine Farm GMT	2016	Icicle Seafoods sold to Cooke Aquaculture
2004	Hennover Salmon - Sold to Johnson Seafarms Ltd.	2010	Camanchaca (salmon division) - Sold to Luksic Group	2016	Gray Aqua sold to Marine Harvest
2004	Bressay Salmon - Sold to Foraness Fish (from adm. Receivership)	2011	Salmones Humboldt - Sold to Mitsubishi	2018	Northern Harvest sold to Marine Harvest
2004	Johnson Seafarms sold to city investors	2011	Pesquera Itata+Pesquero El Golfo - merged into Blumar		
2005	Unst Salmon Company - Sold from Biomar to Marine Farms	2011	Landcatch Chile - Sold to Australis Mar		
2005	Kinloch Damph - Sold to Scottish Seafarms	2012	Salmones Frioaysen & Pesquera Landes' freshwater fish cultivation sold to Salmones Friosur		
2005	Murray Seafood Ltd. - Sold from Austevoll Havfiske to PanFish	2012	Cultivos Marinos Chilé – Sold to Cermaq		
2005	Corrie Mohr - Sold to PanFish	2013	Pacific Seafood Aquaculture – Prod rights&permits for 20 licenses sold to Salmone Friosur		
2006	Wester Ross Salmon - MBO	2013	Salmones Multiexport divest parts of coho and trout prod. Into joint venture with Mitsui		
2006	Hjaltland Seafarm - Sold to Grieg Seafood ASA	2013	Trusal sold to/merged with Salmones Pacific Star, with new name Salmones Austral		
2006	Orkney Seafarms - Sold to Scottish Seafarms	2013	Congelados Pacifico sold to Ventisqueros		
2007	Lighthouse Caledonia - Spin-off from Marine Harvest	2014	Nova Austral sold to EWOS		
2010	Northern Aquaculture Ltd - Sold to Grieg Seafood	2014	Acuinova sold to Marine Harvest Chile		
2010	Lighthouse Caledonia - changed name to Scottish Salmon Company	2014	Cermaq – sold to Mitsubishi		
2010	Meridian Salmon Group - Sold to Morpol	2014	Comercial Mirasol – sold to Salmones Humboldt (Mitsubishi)		
2011	Skelda Salmon Farms Limited - Sold to Grieg Seafood	2015	Landcatch Chile - Sold from Australis Mar to AquaGen		
2011	Duncan Salmon Limited - Sold to Grieg Seafood	2018	Salmones Magallanes & Pesquera Eden aquired by AquaChile		
2012	Uyesound Salmon Comp – Sold to Lakeland Unst (Morpol)	2018	Salmones Friosur, Salmones Frioaysen & Piscicola Hornopiren aquired by Los Fiordos (Agrosuper)		
2013	Lewis Salmon – Sold to Marine Harvest Scotland	2018	AquaChile aquired by Agrosuper		
2013	Morpol sold to Marine Harvest	2018	Australis Seafood aquired by Joyvio Group Co. Ltd		
2014	Part of Morpol/Meridian sold to Cooke Aquaculture	2019	Salmones Ice-Val aquired by Blumar		
2015	Thompson Bros Salmon - Sold to Cooke Aquaculture				
2016	Balta Island Seafare - Sold to Cooke Aquaculture				

Appendix

Breeding

Broodstock Bred on selected characteristics eg. growth, disease resistance, maturation, colour

Spawning and fertilisation: Eggs stripped from females and mixed with milt

Eyed eggs: After 25-30 days fertilized eggs show "eyes". The development is depending on temp. 5000 eggs/ litre

Alevins: Small (<2.5 cm). Yolk sack providing first stage nutrition. When absorbed the fish start feeding

Fry/Parr: Start feeding of small fish. Temp 12-14 ºC. Fish is growing in FW sites to around 60-100g. Vaccination and grading important. Adaptation to life in seawater (smoltification)

Growing

Transfer to seawater sites by wellboat or trucks

On-growing in sea-water sites to around 4.5-5,5 kg (ca 16-22 months depending on temperature). Transport to packing station.

Harvesting

Slaughter, gutting and packing

Processing

The total production cycle takes approx. 10-16 months in freshwater plus 14-22 months in seawater = In sum 24-36 months (in Norway)

Appendix

	The history of Mowi
2019	MOWI brand launch
2018	The company once again becomes Mowi
2017-18	Acquisition of Gray Aqua Group and Northern Harvest, and establishes Mowi Canada East
2016	Entered into joint venture with Deep Sea Supply to build, own and operate aquaculture vessels
2013	Acquisition of Morpol
2012	Feed division established
2006	PanFish acquires Marine Harvest
2005	Marine Harvest and Stolt Sea Farm merge
	PanFish acquires Fjord Seafood
	John Fredriksen acquires PanFish
2000	Nutreco acquires Hydro Seafood. New company name: Marine Harvest
1999	Nutreco acquires the Scottish farming operations started by Unilever
1998	Mowi is discontinued as a company name
	Hydro Seafood has sites in Norway, Scotland and Ireland
1996	Hydro Seafood acquires Frøya holding
1990	Hydro Seafood registered 25 June
	Restructuring and consolidation of the industry starts
1985	Hydro increases its holding to 100%
1983	Mowi buys GSP in Scotland and Fanad in Ireland
1975	Mowi becomes a recognised brand
1969	Hydro increases its holding to 50%
1965	Mowi starts working with salmon in Norway
1964	The adventure of Mowi begins

Appendix

Mowi
Mowi is the world's largest producer of farmed salmon, both by volume and revenue, offering seafood products to approximately 70 countries world-wide. The company are represented in 25 countries, employing 14 537 people.

Total revenue for Mowi in 2018 was MEUR 3,814.5 and the harvest quantity of Atlantic salmon was 375,237 tonnes (GWT), which was 17% of the total industry output.

Business areas

	# 4	#1	#1
	Feed	**Farming**	**Sales and Marketing**
Position	348,402 tonnes vs. global salmonid feed production of ~4 m tonnes	375,237 tonnes vs. global production of ~2.18m tonnes (16%)	Leading position in Consumer products Global sales network
Operations	Started in Norway in 2014. Scotland to commence operations in 2019	Norway, Chile, Scotland, Canada, Ireland, Faroe Islands	Operations in 25 countries
Volumes	520,000 tonnes capacity	375,237 tonnes in 2018	
Op EBIT 2018	EUR 9.6m	EUR 625.2m	EUR 139.0m

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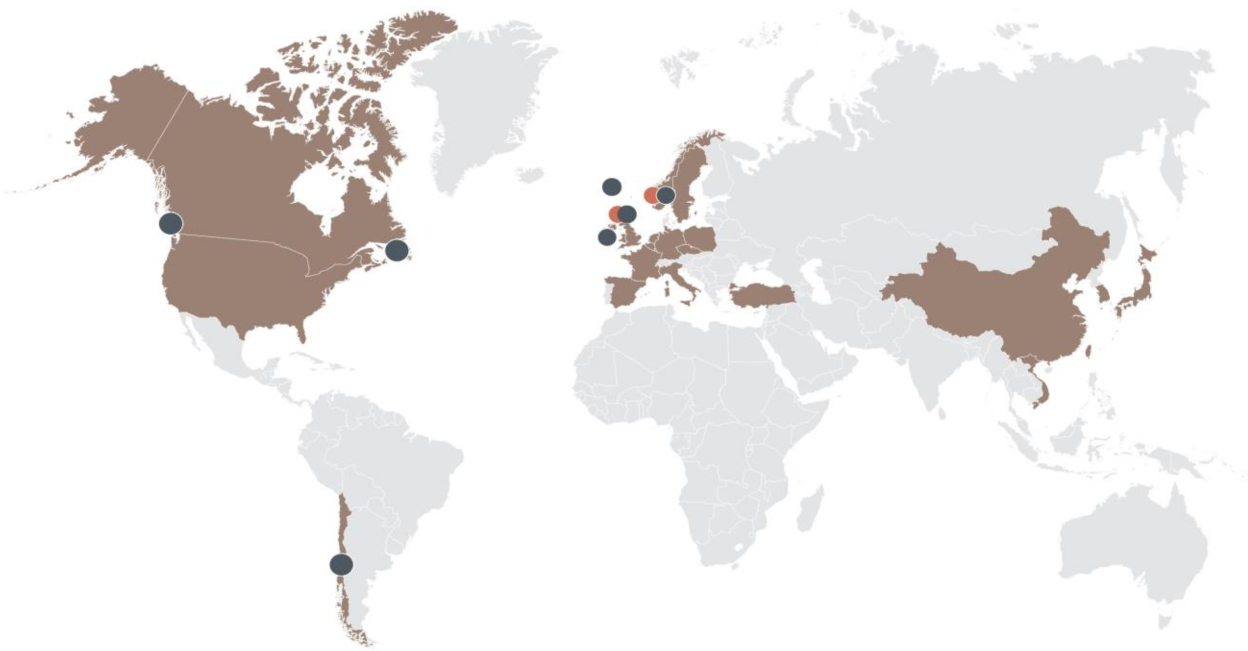
Appendix



Feed	Production Capacity	2018	2017	2016	2015	2014	FTE
		Produced in Norway					
Norway	350 000	348 402	305 174	310 242	281 655	128 807	73
Scotland	170 000						37
Total	520 000						110

Farming	Guidance 2019	2018	2017	2016	2015	2014	FTE
		GWT					
Norway	236 000	230 427	210 152	235 962	254 751	258 021	1 622
Chile	62 500	53 165	44 894	45 046	50 144	48 858	1 239
Canada	55 000	39 267	39 389	36 931	62 482	67 504	1 029
Scotland	60 000	38 444	60 186	43 349	40 112	26 697	752
Irland	9 000	6 238	9 745	8 441	9 736	6 260	240
Faroes	7 500	7 697	5 980	10 893	2 923	11 532	75
Total	430 000	375 237	370 346	380 621	420 617	419 422	4 958

Sales & Marketing	FTE
Europe	7 458
Asia	1 283
Americas	667
Total	9 407

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Appendix

Sources of industry and market information

Mowi:	www.mowi.com
Other	
Kontali Analyse:	www.kontali.no
Intrafish:	www.intrafish.no
Norwegian Directorate of Fisheries:	www.fiskeridirektoratet.no
Norwegian Ministry of Trade, Industry and Fisheries:	www.fkd.dep.no
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